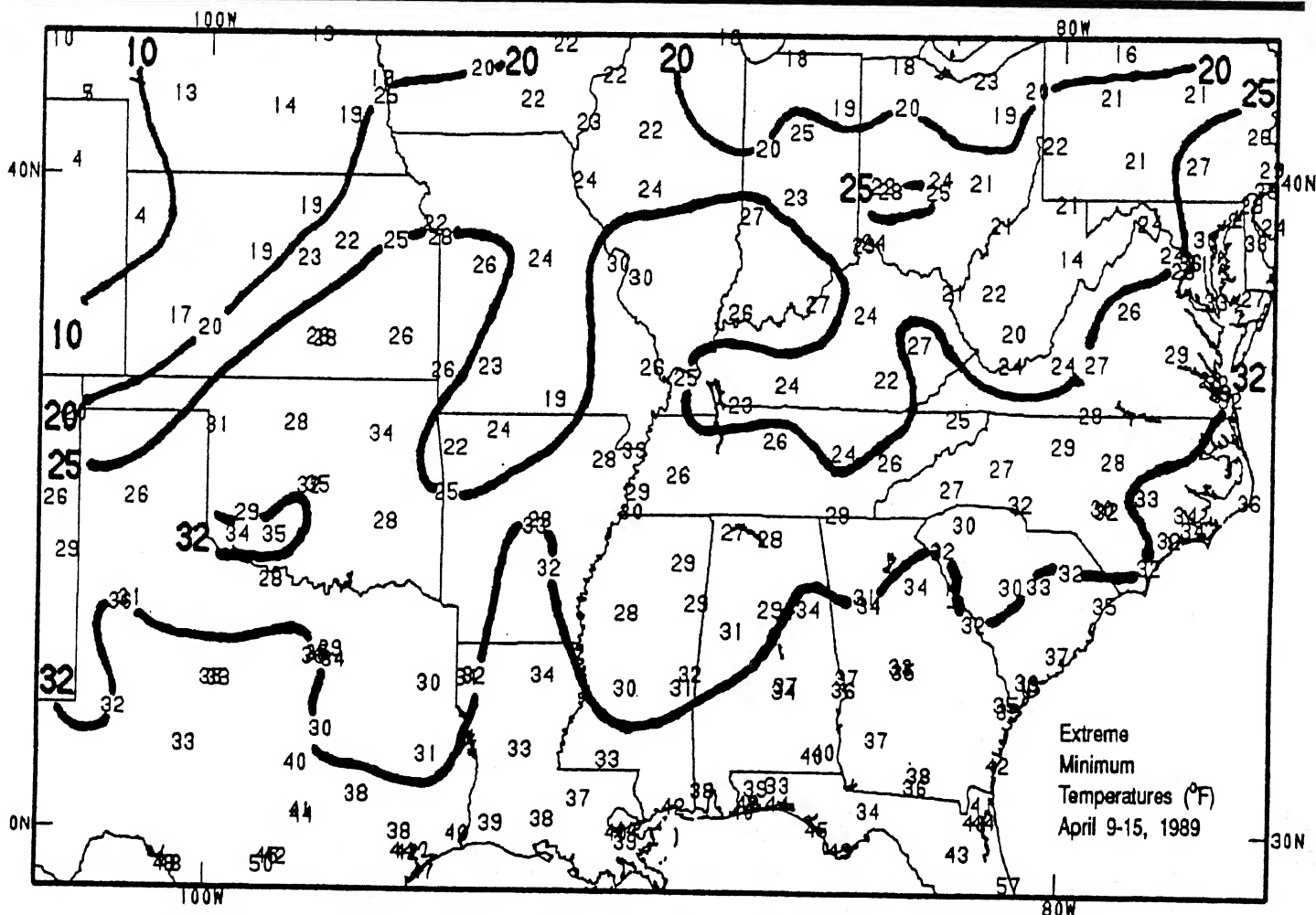


WEEKLY CLIMATE BULLETIN

No. 89/15

Washington, DC

April 15, 1989



A LATE-SEASON COLD SPELL SENT TEMPERATURES PLUNGING BELOW 32°F AS FAR SOUTH AS NORTHERN TEXAS AND LOUISIANA, CENTRAL MISSISSIPPI AND ALABAMA, AND THROUGHOUT MOST OF THE CAROLINAS WHILE LOWS IN THE TEENS WERE RECORDED IN THE CENTRAL GREAT PLAINS AND LOWER GREAT LAKES.

UNITED STATES DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE - NATIONAL METEOROLOGICAL CENTER

WEEKLY CLIMATE BULLETIN

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This Bulletin is issued weekly by the Climate Analysis Center and is designed to indicate, in a brief, concise format, current surface climatic conditions in the United States and around the world. The Bulletin contains:

- Highlights of major global climatic events and anomalies.
- U.S. climatic conditions for the previous week.
- U.S. apparent temperatures (summer) or wind chill (winter).
- Global two-week temperature anomalies.
- Global four-week precipitation anomalies.
- Global monthly temperature and precipitation anomalies.
- Global three-month precipitation anomalies (once a month).
- Global twelve-month precipitation anomalies (every 3 months).
- Global temperature anomalies for winter and summer seasons.
- Special climate summaries, explanations, etc. (as appropriate).

Most analyses contained in this Bulletin are based on preliminary, unchecked data received at the Center via the Global Telecommunication System. Similar analyses based on final, checked data are likely to differ to some extent from those presented here.

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GLOBAL CLIMATE HIGHLIGHTS

MAJOR CLIMATIC EVENTS AND ANOMALIES AS OF APRIL 15, 1989

1. Coastal sections of British Columbia and Alaska:

ANOTHER DRY WEEK.

Most stations reported less than 19 mm of precipitation as very dry weather continued [8 weeks].

2. Western United States:

EARLY SEASON HEAT WAVE.

Temperatures averaged up to 9°C above normal as unseasonably warm conditions persisted (see U. S. Weekly Climate Highlights) [8 weeks].

3. Central United States:

ABNORMALLY DRY CONDITIONS OCCUR.

Little or no precipitation fell in parts of the central United States as very dry conditions developed (see U. S. Weekly Climate Highlights) [4 weeks].

4. Southeastern United States:

COLD WEATHER REPORTED.

Unusually cold Canadian air invaded the southeastern United States as temperatures reached 8°C below normal (see U. S. Weekly Climate Highlights) [2 weeks].

5. Uruguay and Eastern Argentina:

AREA STILL DRY.

Although as much as 135 mm of precipitation fell in northern Argentina most of the region remained abnormally dry. Many stations will enter the approaching dry season with significant long-term deficits [42 weeks].

6. Central and Southern Europe:

REGION REMAINS WARM.

Unusually warm conditions persisted as temperatures averaged as much as 12°C above normal (see Special Climate Summary) [14 weeks].

7. Eastern Asia:

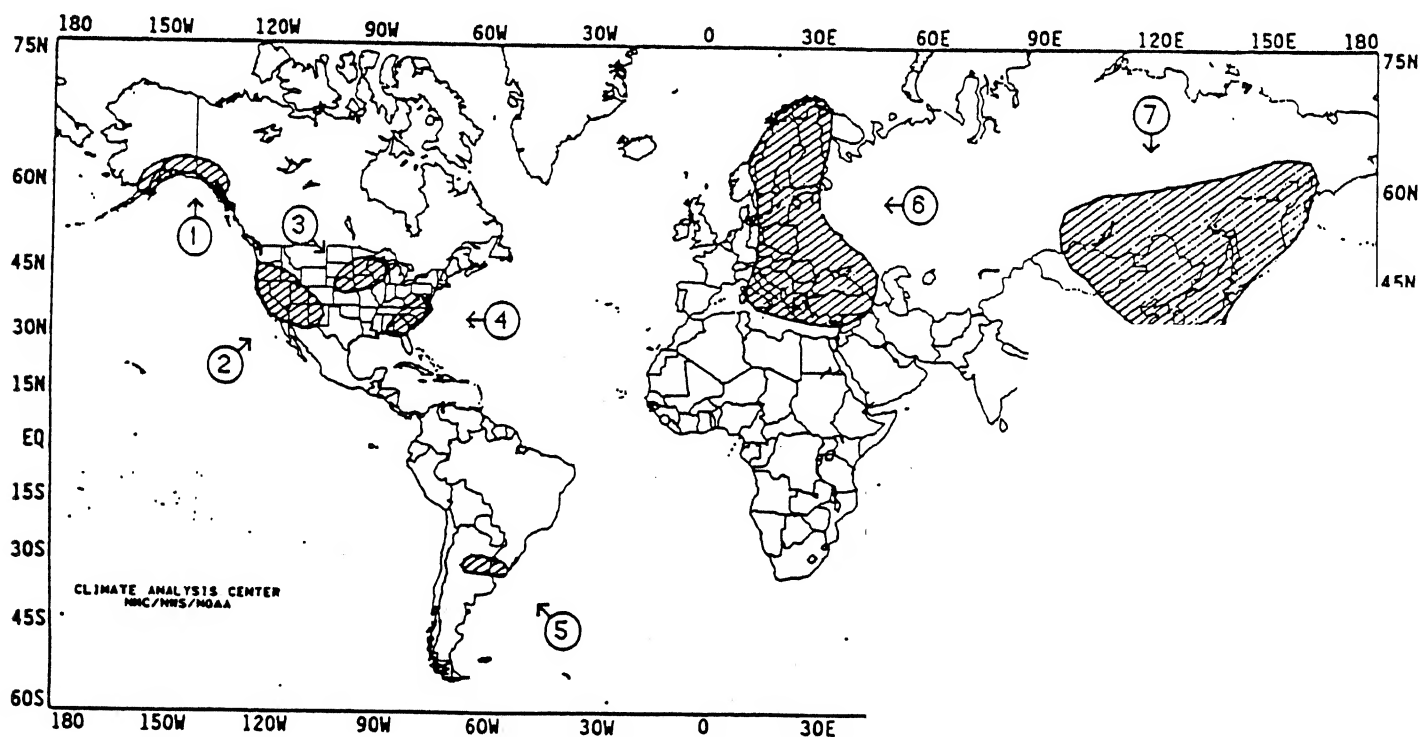
MORE WARM WEATHER.

Abnormally high temperatures, reaching 12°C above normal in Siberia [27 weeks] and 7°C above normal in China, Korea, and Japan [9 weeks], continued across the region.

8. Australia:

"BIG WET" CONTINUES.

More heavy rains, up to 184 mm, fell at stations in eastern Australia as unusually wet weather persisted [5 weeks].



EXPLANATION

TEXT: Approximate duration of anomalies is in brackets. Precipitation week's values.

MAP: Approximate locations of major anomalies and episodic events at current two week temperature anomalies, four week precipitation anomalies.

UNITED STATES WEEKLY CLIMATE HIGHLIGHTS

FOR THE WEEK OF APRIL 9 THROUGH APRIL 15, 1989.

Much of the West experienced warm and dry weather while unseasonably cold air covered the eastern two-thirds of the nation. In addition to the low temperatures, moderate to heavy snow fell on the parched regions of eastern Colorado and western Kansas (up to 11 inches at Goodland, KS), providing some relief from long-term dryness. Farther east, a series of low pressure centers off the Carolina coast blanketed northeastern North Carolina with up to 5 inches of snow on Tuesday, making April 11 the latest date with measurable snow in 110 years of record at Wilmington, NC. Cold northwesterly winds also produced heavy snow squalls along the Great Lakes snowbelt regions. Overall, much of the country experienced relatively dry weather in response to a large dome of high pressure over the central and eastern U.S. Early in the week, however, an upper-air disturbance over the southern Plains and several waves along a slow-moving cold front off the Carolina coast dropped light rainshowers (in addition to the previously-mentioned snowfall) to parts of the southern Rockies and Plains and along the southern Atlantic Coast, respectively. By mid-week, the combination of an upper-air disturbance and moist southeasterly Gulf flow triggered scattered thunderstorms in southern Texas. Towards the week's end, a low pressure center developed in the Gulf of Mexico and raced northeastward up the Atlantic Coast. This storm, in association with a cold front tracking eastward across the lower Great Lakes, brought widespread rainshowers to the Ohio and Tennessee Valleys, mid-Atlantic, and New England and heavy thunderstorms to the southern Atlantic Coast. With this week's precipitation, Cape Hatteras, NC set a new maximum April precipitation record (7.26 inches), and 15 days still remained in the month. In Alaska, the eleventh consecutive week of unusually dry and tranquil weather along the state's southern coast (including Prince William Sound, site of the oil spill) has slowed the dissipation of the oil slicks. Flooding along the Red River in eastern North Dakota and western Minnesota continued due to rapid snowmelt.

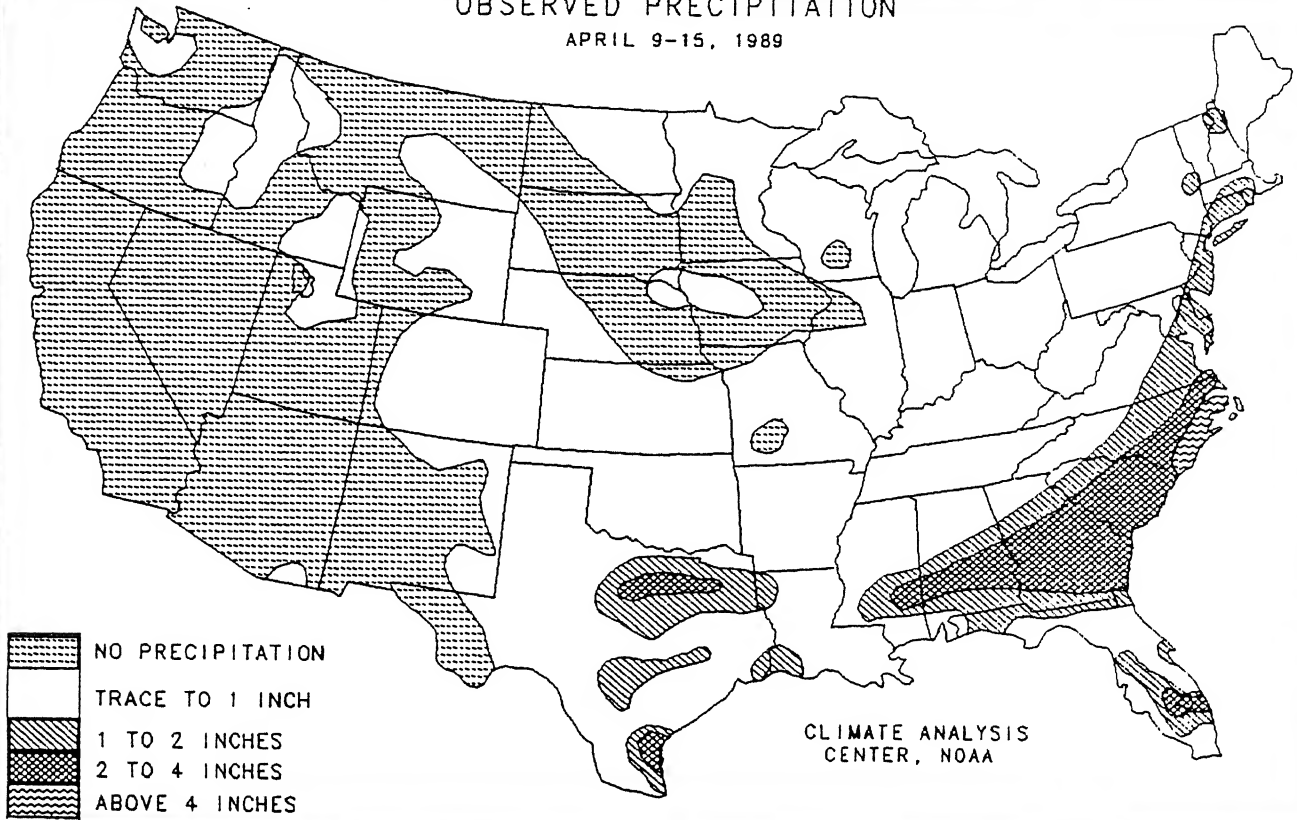
According to the River Forecast Centers, the greatest weekly precipitation amounts (between 2 and 5 inches) were reported from southeastern Mississippi

northeastward to northeastern North Carolina and southward to northern Florida (see Table 1 and Figure 1). Except for some moderate precipitation during late February and mid-March, this was the first substantial rainfall (more than 2 inches) in the eastern and southern portions of Georgia and South Carolina since last autumn. Elsewhere, scattered locations along coastal New England, in southern and north-central Texas, Hawaii, southeastern Alaska, and southern Florida received moderate to heavy precipitation, easing the threat of wildfires and providing some relief from long-term dryness in the latter area. Light to moderate totals occurred in the southern third of the Plains and throughout most of the nation east of the Mississippi River. Little or no precipitation fell along Alaska's southern coast and on much of the western half of the country with the exception of the southern Plains.

Unseasonably warm conditions continued throughout the western third of the U.S. as the greatest positive temperature departures (between $+10^{\circ}$ and $+16^{\circ}\text{F}$) were located in the Intermountain West (see Table 2). For the second consecutive week, highs surpassing 90°F occurred throughout the desert Southwest and central California although coastal locations such as Los Angeles were much cooler than the previous week (see Figure 2). Farther north, much of Alaska experienced mild weather as temperatures in the western and northern portions of the state averaged up to 22°F above normal. In sharp contrast, a late-season cold spell chilled much of the eastern two-thirds of the country. The greatest negative temperature departures (between -11° and -13°F) were observed across the southern Great Plains, Southeast, and lower Ohio Valley (see Table 3). Subfreezing temperatures were recorded as far south as northern Texas, northern Louisiana, and central Mississippi and Alabama while lows in the teens prevailed across the northern half of the Plains and western Great Lakes (see Figure 3). More than 70 stations tied or set daily minimum temperature records during the week as some of these locations also established new April and/or late season minimum temperature records.

OBSERVED PRECIPITATION

APRIL 9-15, 1989



DEPARTURE OF AVERAGE TEMPERATURE FROM NORMAL (°F)

APRIL 9-15, 1989

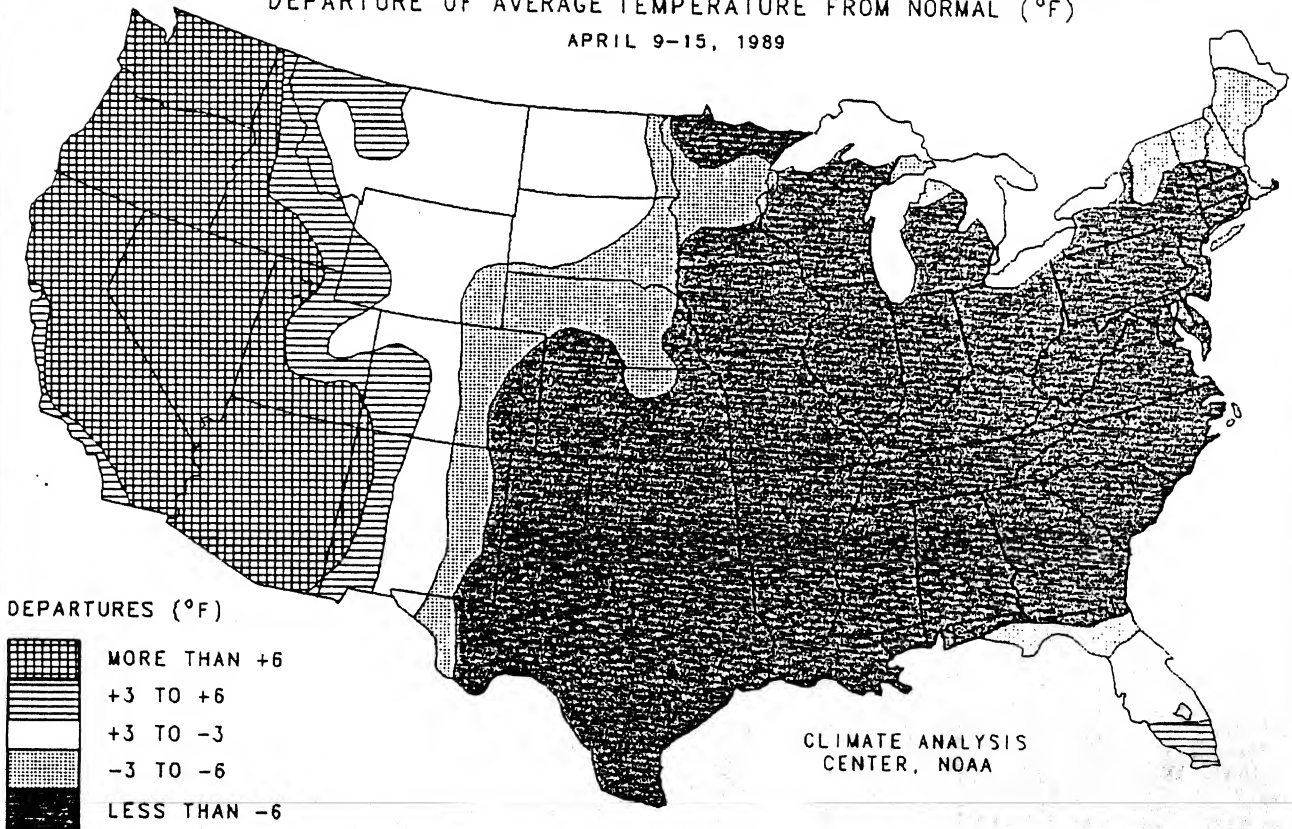


TABLE 1. Selected stations with more than 2.00 inches of precipitation for the week.

<u>Station</u>	<u>Total(In)</u>	<u>Station</u>	<u>Total(In)</u>
Wilmington, NC	5.44	Montgomery, AL	2.58
Cape Hatteras, NC	4.40	Brunswick, GA	2.56
Kahului, Maui, HI	4.17	Sumter/Shaw AFB, SC	2.56
Cherry Point MCAS, NC	4.00	Savannah/Hunter AFB, SC	2.51
West Palm Beach, FL	3.92	Columbus, GA	2.44
Jacksonville/New River NDB, NC	3.65	Savannah, GA	2.38
Myrtle Beach AFB, SC	3.35	Albany, GA	2.30
Charleston, SC	3.34	Columbus/Ft. Benning, GA	2.25
New Bern, NC	3.20	Columbia, SC	2.23
Kingsville NAS, TX	2.99	Yakutat, AK	2.21
Macon, GA	2.89	Ft. Worth/Meacham AFB, TX	2.10
Corpus Christi, TX	2.59	Valparaiso/Eglin AFB, FL	2.09

TABLE 2. Selected stations with temperatures averaging 8.0°F or more ABOVE normal for the week.

<u>Degrees F</u>		<u>Degrees F</u>	
<u>Station</u>	<u>Dep.</u> <u>Avg.</u>	<u>Station</u>	<u>Dep.</u> <u>Avg.</u>
Barrow, AK	+21.8 17.9	Blythe, CA	+10.8 80.5
Kotzebue, AK	+18.1 28.5	Winnemucca, NV	+10.8 55.0
Phoenix, AZ	+16.0 82.9	Portland, OR	+10.6 60.2
Prescott, AZ	+13.8 62.3	Salem, OR	+10.6 58.8
Victorville/George AFB, CA	+13.7 70.6	Yuma, AZ	+10.5 80.4
Medford, OR	+13.7 63.2	Eugene, OR	+10.3 59.3
Fresno, CA	+13.4 72.7	Big Delta, AK	+ 9.5 38.4
Reno, NV	+13.2 58.7	McGrath, AK	+ 9.2 34.1
Las Vegas, NV	+12.8 75.1	Sacramento, CA	+ 9.1 66.4
Glendale/Luke AFB, AZ	+12.7 79.2	Paso Robles, CA	+ 9.1 64.3
Bakersfield, CA	+12.7 74.4	Burns, OR	+ 9.0 51.1
Nome, AK	+12.5 28.3	Fairbanks, AK	+ 9.0 37.1
Unalakleet, AK	+12.2 31.8	Ely, NV	+ 8.9 48.9
Tucson, AZ	+11.4 75.4	Lewiston, ID	+ 8.8 58.0
Lovelock, NV	+11.4 58.6	Elko, NV	+ 8.8 51.1
Tucson/Davis-Monthan AFB, AZ	+11.2 74.8	Imperial, CA	+ 8.6 77.8
Redding, CA	+11.2 70.5	Bethel, AK	+ 8.6 30.3
Bettles, AK	+11.2 30.9	Seattle/Tacoma, WA	+ 8.5 56.5
Redmond, OR	+11.0 53.6		

TABLE 3. Selected stations with temperatures averaging 11.0°F or more BELOW normal for the week.

<u>Degrees F</u>		<u>Degrees F</u>	
<u>Station</u>	<u>Dep.</u> <u>Avg.</u>	<u>Station</u>	<u>Dep.</u> <u>Avg.</u>
Abilene, TX	-13.4 51.0	Macon, GA	-11.8 52.6
Bowling Green, KY	-13.1 43.2	Charleston, WV	-11.7 42.6
Birmingham, AL	-12.9 49.0	Elkins, WV	-11.6 37.7
Dallas/Ft. Worth, TX	-12.9 51.7	Crossville, TN	-11.6 42.7
San Angelo, TX	-12.9 52.9	Montgomery, AL	-11.6 52.8
Muscle Shoals, AL	-12.5 48.0	Paducah, KY	-11.5 45.5
Knoxville, TN	-12.4 46.2	Wichita Falls, TX	-11.5 51.2
Jackson, TN	-12.3 47.8	Jackson, MS	-11.4 52.6
Sumter/Shaw AFB, SC	-12.3 50.1	College Station, TX	-11.4 55.8
Macon/Warner-Robins AFB, GA	-12.3 52.6	Columbia, SC	-11.3 51.4
Austin, TX	-12.3 55.6	Del Rio, TX	-11.3 59.7
Nashville, TN	-12.2 46.5	Alexandria/England AFB, LA	-11.2 54.8
Huntsville, AL	-12.2 48.4	Lexington, KY	-11.1 42.8
Tuscaloosa, AL	-12.1 51.1	Greenwood, MS	-11.1 52.1
Huntington, WV	-12.0 43.1	Lufkin, TX	-11.1 55.6
Pine Bluff, AR	-12.0 51.8	Victoria, TX	-11.1 59.5
Waco, TX	-12.0 54.3	Florence, SC	-11.0 51.8
San Antonio, TX	-12.0 56.9	Albany, GA	-11.0 55.4
Meridian, MS	-11.9 51.9		

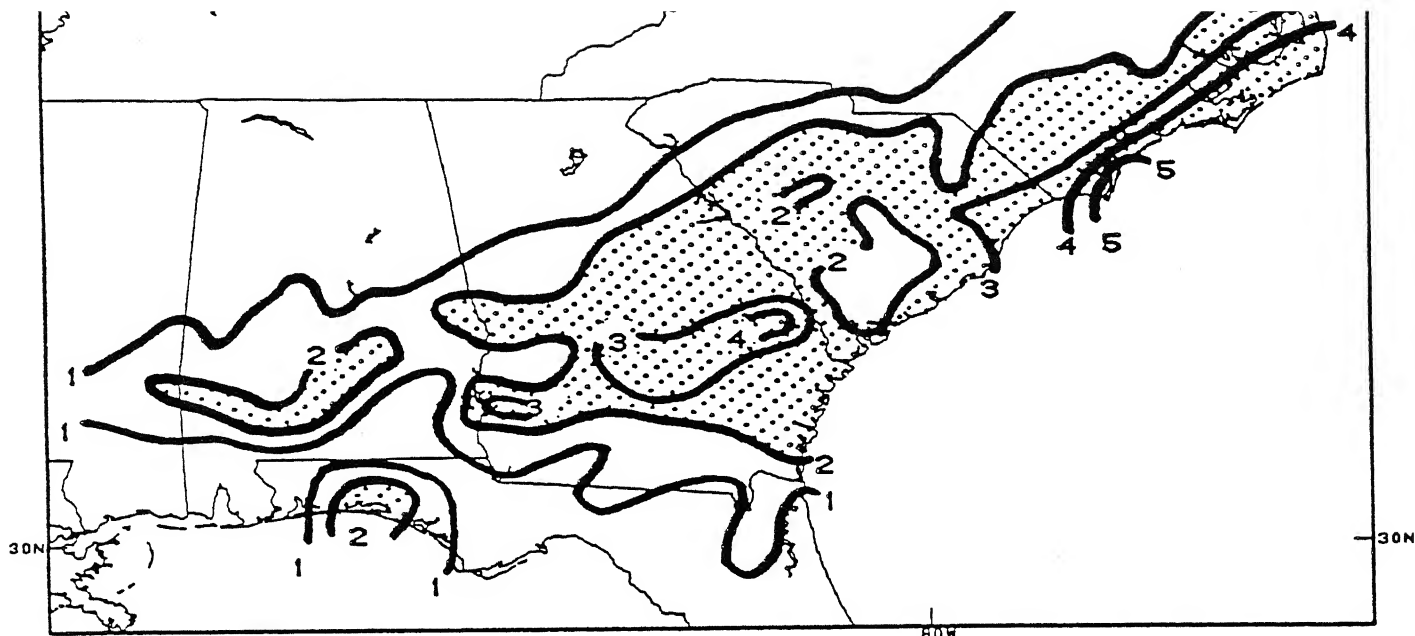


Figure 1. Total precipitation (inches) during the week of April 9-15, 1989 based upon first order synoptic, airways, and the River Forecast Center stations. Isopleths are drawn every inch, and stippled areas are more than 2 inches. For the first time since last autumn, heavy precipitation (>2") occurred in the southern and eastern sections of Georgia and South Carolina.

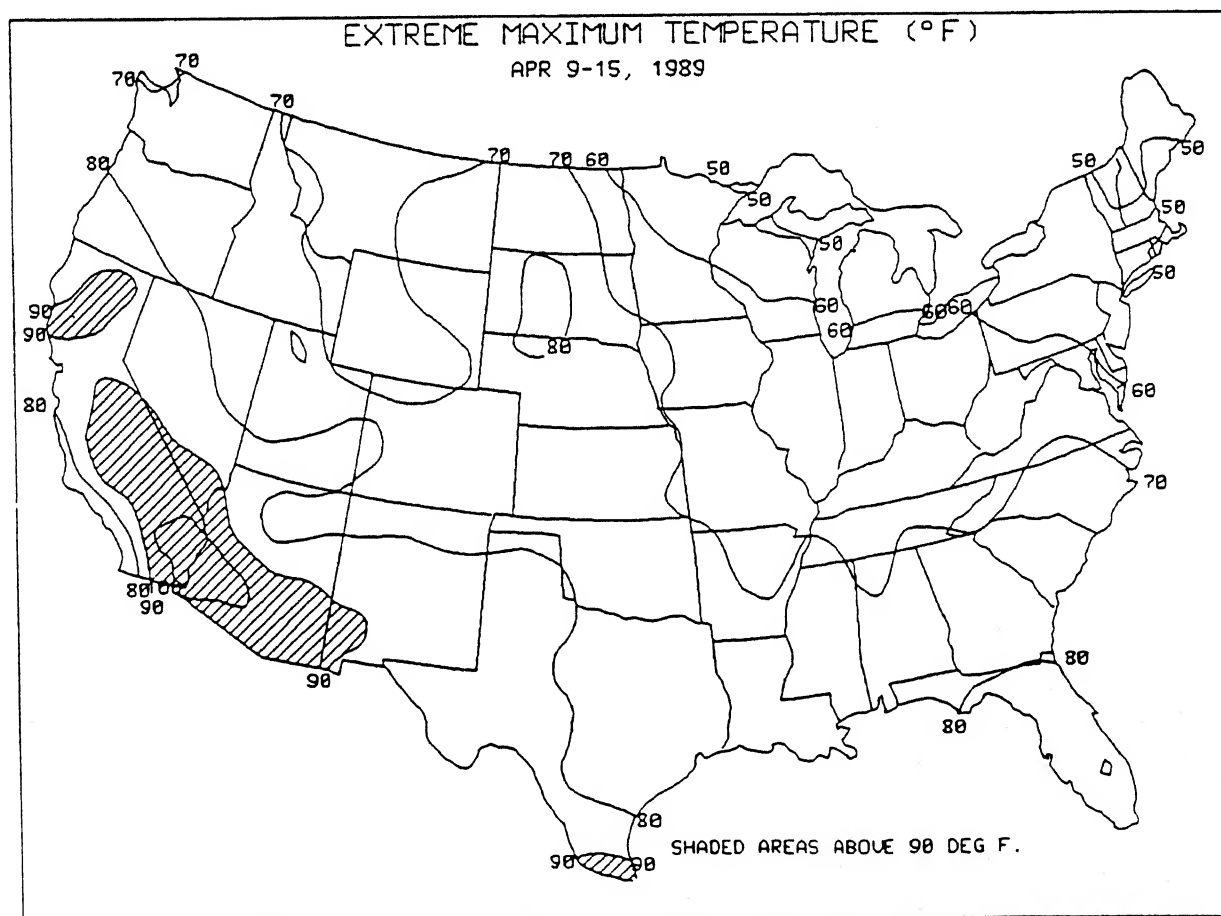


Figure 2. Extreme maximum temperatures (°F) during the week of April 9-15, 1989. Extremely warm weather continued in the Southwest as many locations recorded highs of 90°F or more while the northern Great Plains warmed into the seventies and eighties by the end of the week after observing lows in the teens and single digits early in the week (see Figure 2).

EXTREME MINIMUM TEMPERATURE (°F)

APR 9-15, 1989

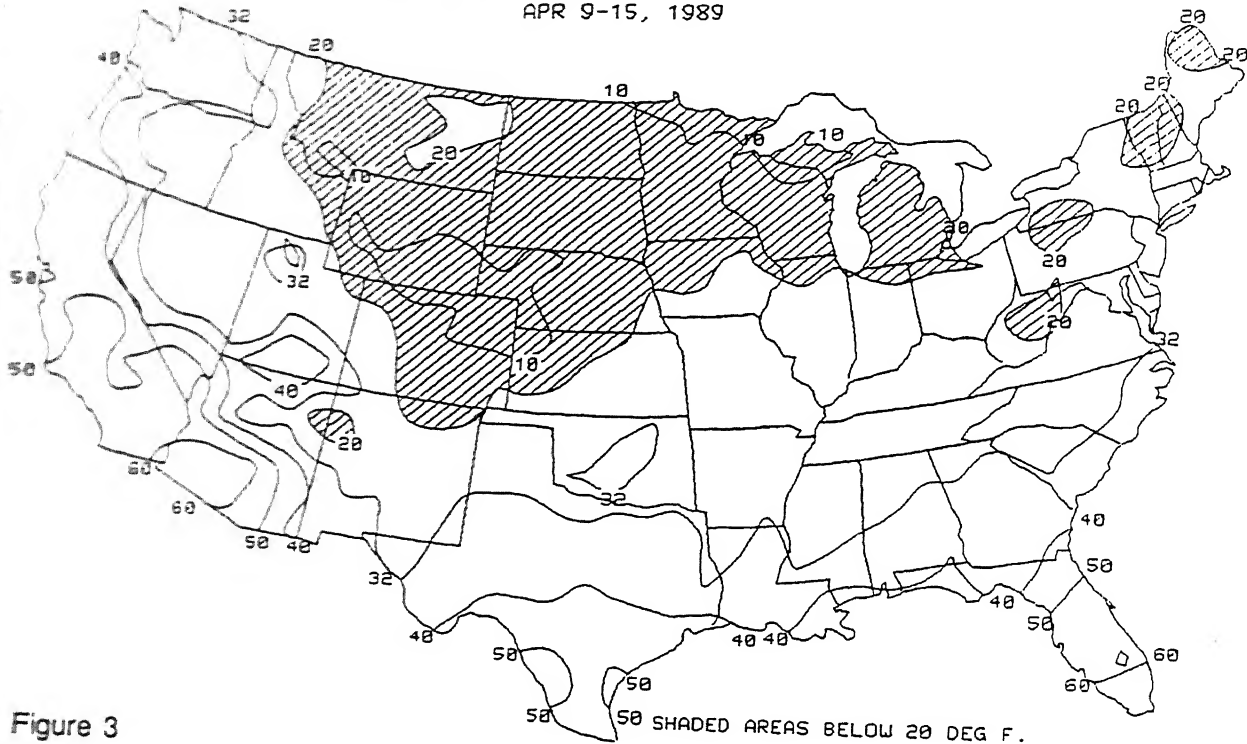
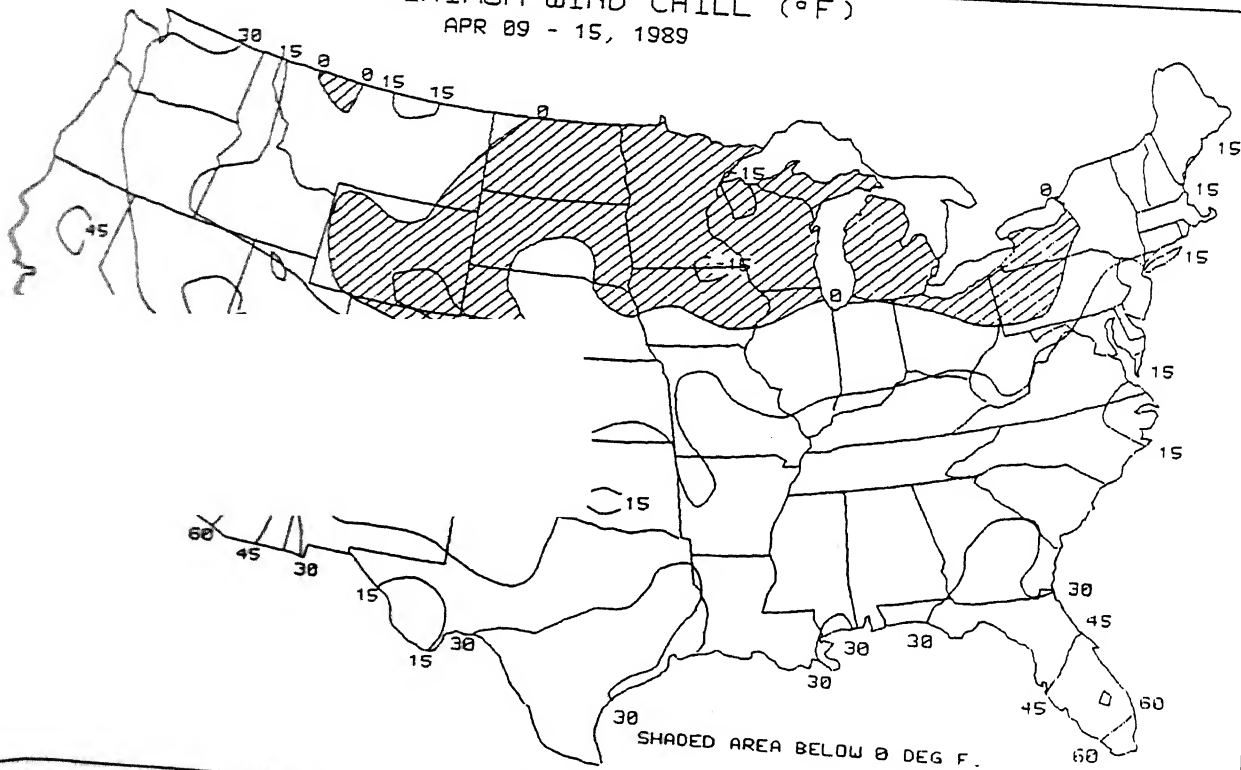


Figure 3

Unseasonably cold air covered much of the eastern two-thirds of the nation as freezing temperatures were recorded as far south as the lower Mississippi Valley while teens were observed across the northern half of the Plains and upper Midwest (top). Subzero wind chills occurred throughout the northern half of the Plains, the upper Midwest, and the Great Lakes (bottom).

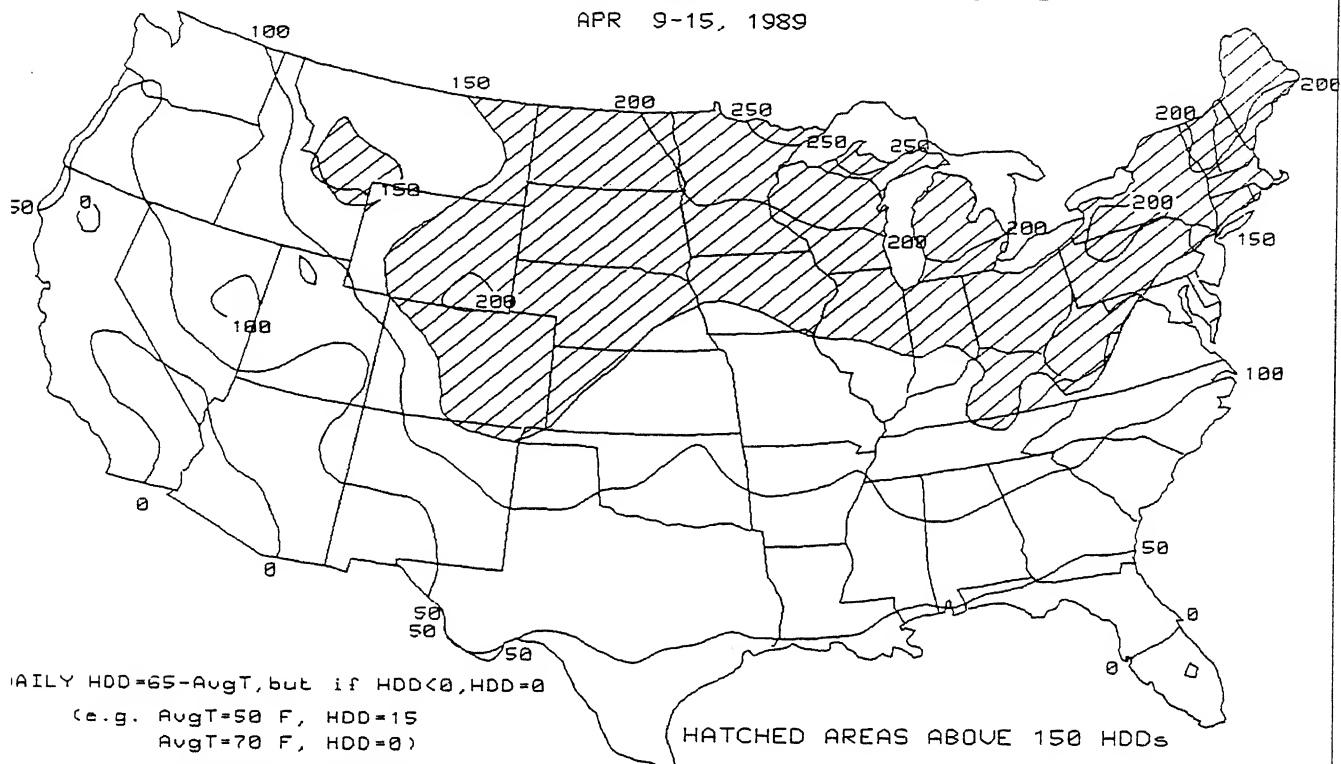
MINIMUM WIND CHILL (°F)

APR 09 - 15, 1989



WEEKLY TOTAL HEATING DEGREE-DAYS

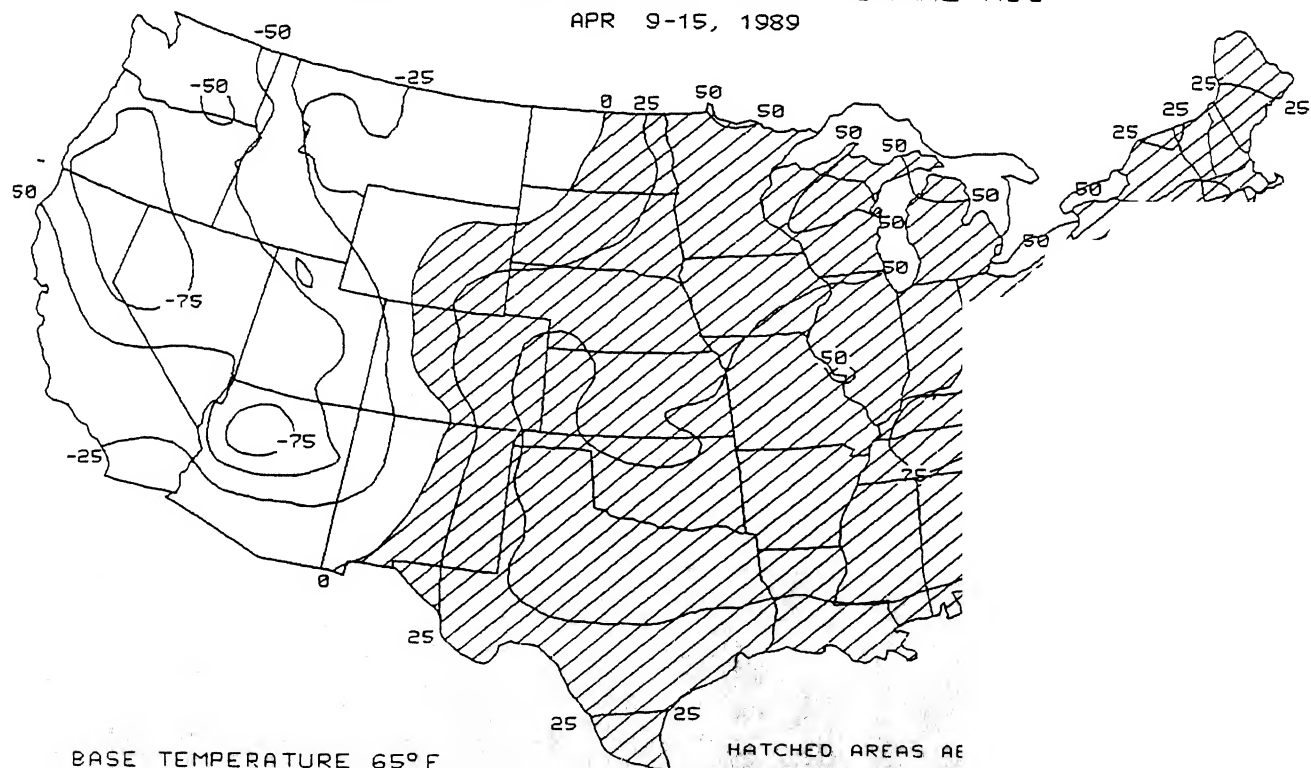
APR 9-15, 1989



With abnormally cold conditions prevailing over the eastern two-thirds of the U.S. last week, total heating usage surpassed 200 HDDs in the upper Midwest, Great Lakes, and northern New England (top) while much of the Southeast experienced more than double the normal weekly heating demand (bottom).

WEEKLY DEPARTURE FROM NORMAL HDD

APR 9-15, 1989



The Drought Severity, or Palmer, Index is an index of meteorological drought (or moisture excess) and indicates prolonged abnormal conditions affecting water-sensitive economics. The index usually ranges from about -6 to +6, with negative values denoting dry spells and positive values, wet spells of weather (categories of values are given under the accompanying map). The equations for the index were derived from monthly average data and based on the concept of a balance between moisture supply and demand (Palmer, 1965). The equations have been modified to compute the index on a weekly basis for publication in the Bulletin. Input data consists of weekly temperature averages and precipitation totals for 350 climate divisions in the United States and Puerto Rico.

The index is a sum of the current moisture anomaly and a portion of the previous index to include the effect of the duration of the drought or wet spell. The moisture anomaly is the product of a climate weighting factor and the moisture departure. The weighting factor allows the index to have a reasonably comparable significance for different locations and time of year. An index value for a division in Florida would have the same local implication as a similar value in a more arid division in western Kansas. The moisture departure is the difference of water supply and demand. Supply is precipitation and stored soil moisture, and demand is the potential evapotranspiration, the amount needed to recharge the soil, and runoff needed to keep the rivers, lakes, and reservoirs at a normal level. The runoff and soil recharge and loss are computed by keeping a hydrologic accounting of moisture storage in two soil layers. The surface layer can store one inch, while the available capacity in the underlying layer depends on the soil characteristics of the division being measured. Potential evapotranspiration is derived from Thornthwaite's method (1948).

The index is measured from the start of a wet or dry spell and is sometimes ambiguous until a weather spell is established. A week of normal or better rainfall is welcome in an area that has experienced a long drought, but may be only a brief respite and not the end of the drought. Once the weather spell is established (by computing a 100 percent "probability" that an opposite spell has ended), the final value is assigned. To make the program have a real-time significance, a value is assigned based on a greater than 50 percent "probability" that the opposite weather spell has ended. This is not entirely satisfactory, but it does allow the index to have a value when there is a doubt that it should be positive or negative.

One aspect that should be noted is that the demand part of the computations includes three parameters--potential evapotranspiration, recharge of soil moisture, and runoff--any one of which may produce negative values. If only enough rain fell to satisfy the expected evapotranspiration but not enough to supply the recharge and runoff, then a negative index would result. If such an odd situation continued, agriculture would progress at a normal pace but a worsening drought would be indicated. Shallow wells and springs would dry and the levels of rivers, lakes, and reservoirs would fall. Serious economic stress to the livestock trade, industries, and cities would eventually result. Then if rainfall fell below the minimum needed for agriculture, crops would suffer drastic and rapid decline because there would be no reserve water in the soil. Such a situation, to some extent, occurred during the Northeast drought in the mid-1960's when New York City almost ran out of water.

A detailed explanation and examination of the index is given by Alley (1984). Both Alley and Karl (1983) address the sensitivity of the index and list some limitations.

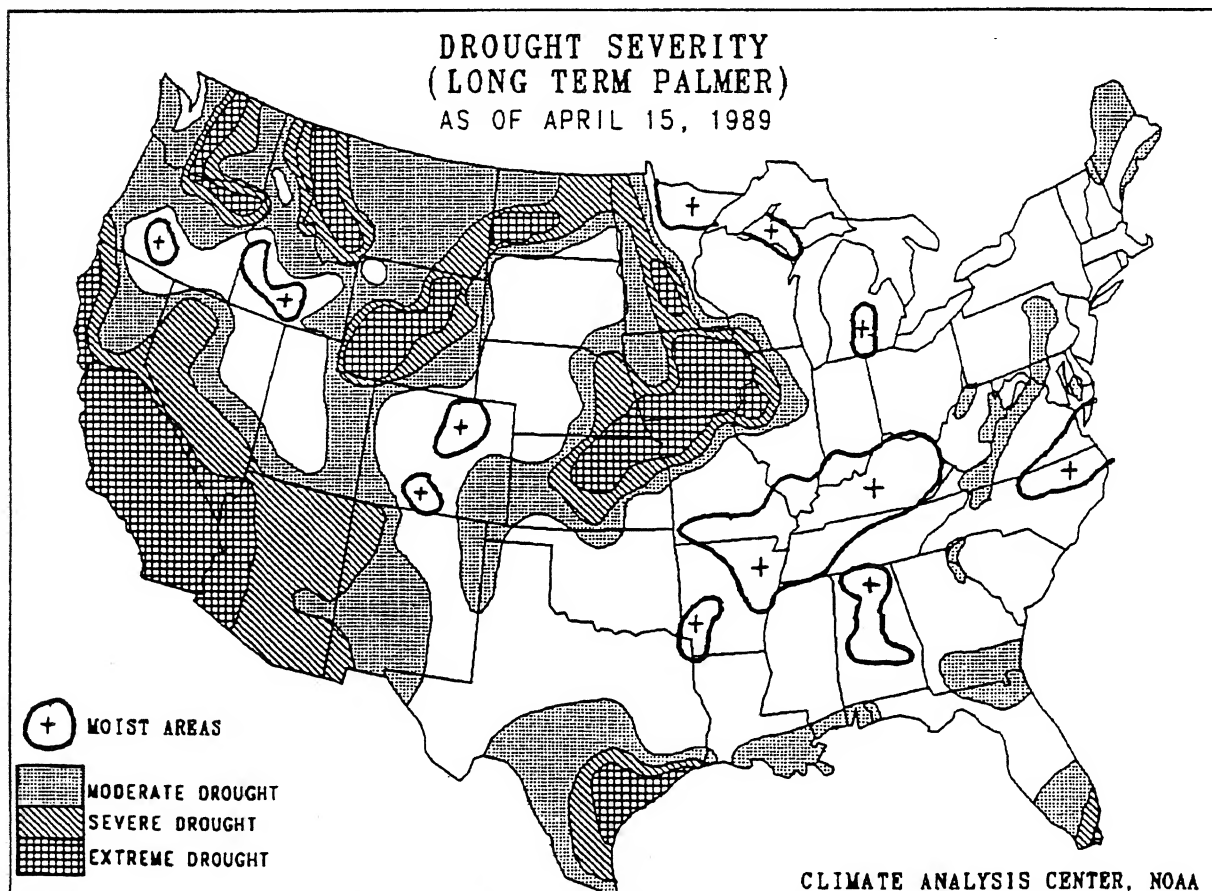
References:

- Alley, W., 1984: "The Palmer Drought Severity Index: Limitations and Assumptions," *Journal of Climate and Applied Meteorology*, 23, 1100-1109.
- Karl, T.R., 1983: "Some Spatial Characteristics of Drought Duration in the United States," *Journal of Climate and Applied Meteorology*, 22, 1356-1366.
- Palmer, W.C., 1965: *Meteorological Drought*, Weather Bureau Research Paper No. 45, U.S. Dept. of Commerce, Washington, DC, 58pp.
- Thornthwaite, C.W., 1948: "An Approach Toward a Rational Classification of Climate," *Geographical Review*, 38, 55-94.

General Categories of PDI

Above +4.0	Extreme Moist Spell	Below -4.0	Extreme Drought
+3.0 to +3.9	Very Moist Spell	-3.0 to -3.9	Severe Drought
+2.0 to +2.9	Unusual Moist Spell	-2.0 to -2.9	Moderate Drought
+1.0 to +1.9	Moist Spell	-1.0 to -1.9	Mild Drought
+0.5 to +0.9	Incipient Moist Spell	-0.4 to -0.9	Incipient Drought
+0.4 to -0.4	Near Normal		

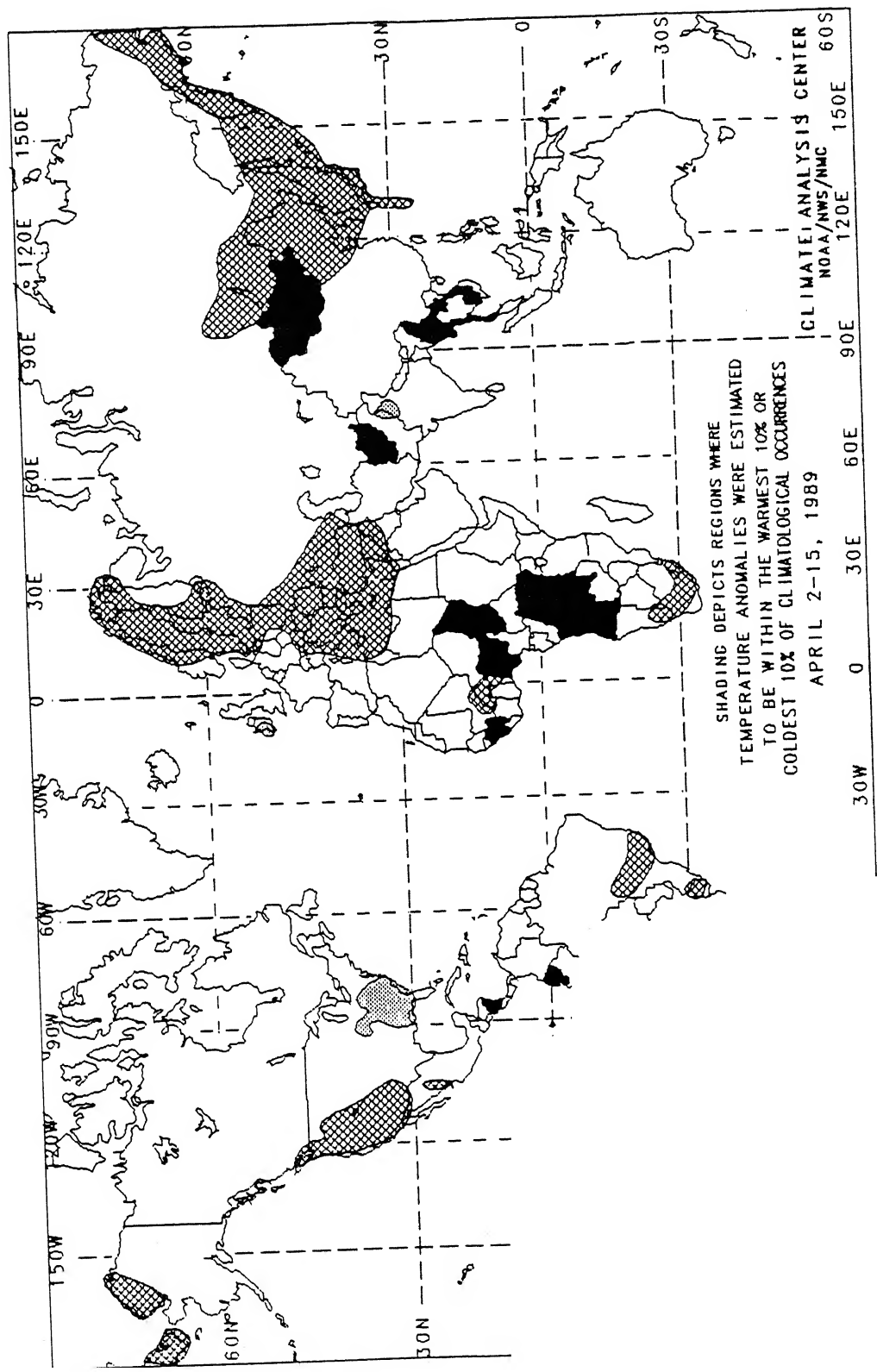
Above article taken from page 4 of the Weekly Weather and Crop Bulletin dated April 21, 1987.



The long-term Palmer Drought Index as analyzed by category (see above table) for the week ending April 15, 1989. Severe or extreme long-term drought still existed in parts of the western Corn Belt, central Great Plains, northern Rockies, and Far West, while unusually moist conditions prevailed in the Ohio and Tennessee Valleys, western Great Lakes, central Rockies, and Carolinas.

GLOBAL TEMPERATURE ANOMALIES

2 WEEKS

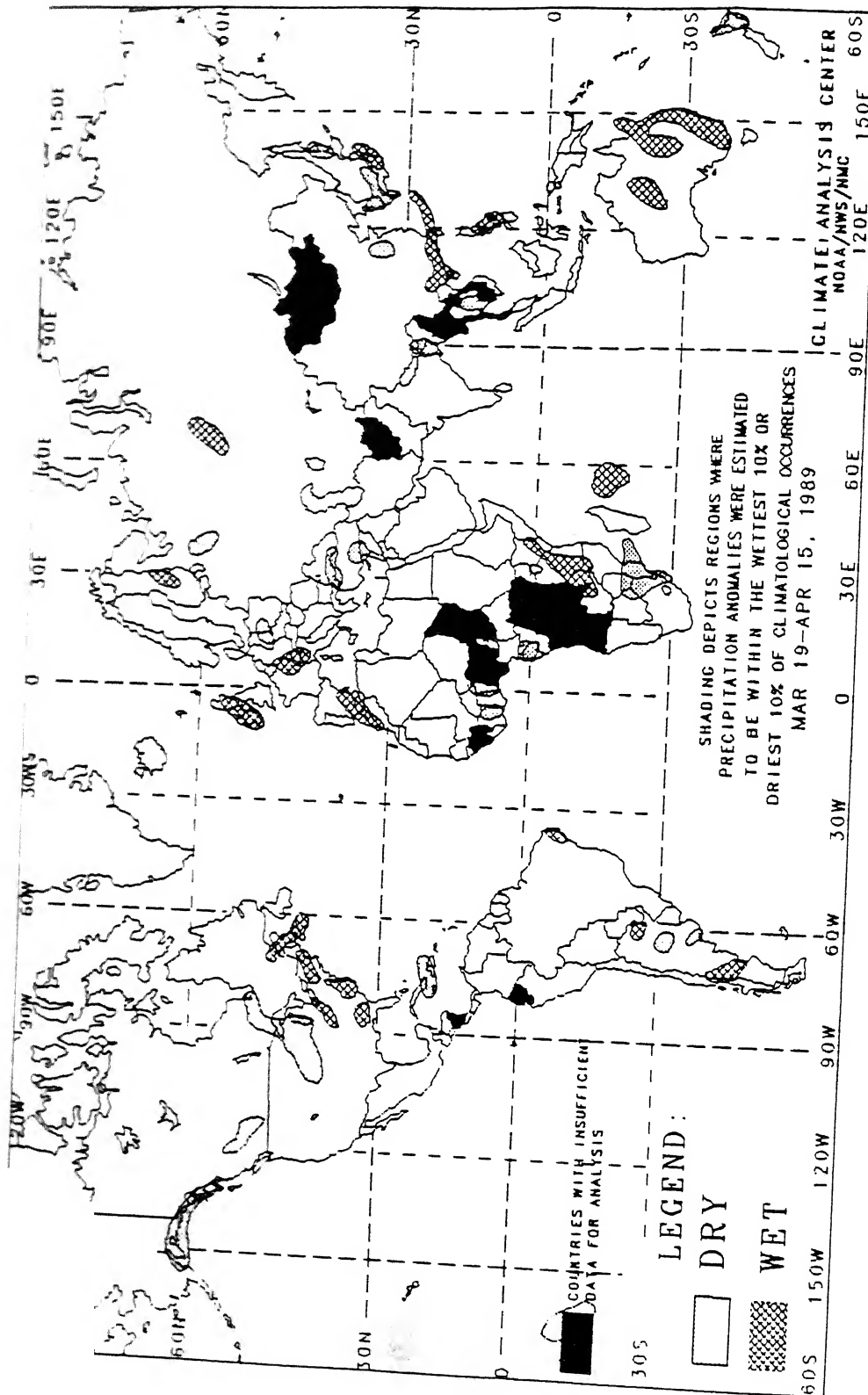


In some regions, insufficient data exist to determine the magnitude of anomalies. These regions are located in parts of tropical Africa, southwestern Asia, interior equatorial South America, and along the Arctic Coast. Either current data are too sparse or incomplete for analysis, or historical data are insufficient for determining percentiles, or both. No attempt has been made to estimate the magnitude of anomalies in such regions.

This chart shows general areas of two week temperature anomalies. Caution must be used in relating it to local conditions, especially in mountainous regions.

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4 WEEKS



The anomalies on this chart are based on approximately 2500 observing stations for which at least 27 days of precipitation observations (including zero amounts) were received or estimated from synoptic reports. As a result of both missing observations and the use of estimates from synoptic reports (which are conservative), a dry bias in the total precipitation amount may exist for some stations used in this analysis. This in turn may have resulted in an overestimation of the extent of some dry anomalies.

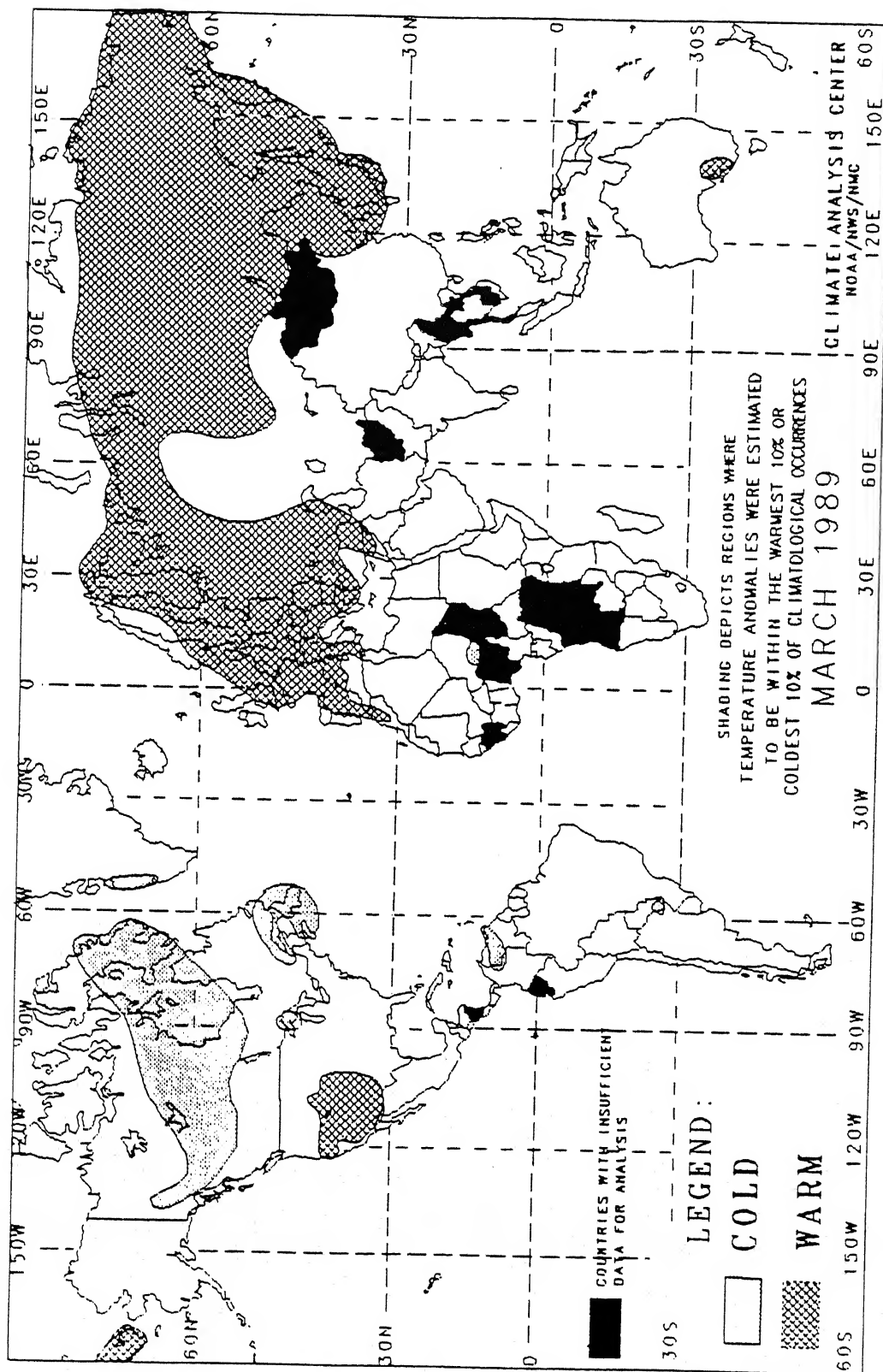
In climatologically arid regions where normal precipitation for the four week period is less than 20 mm, dry anomalies are not depicted. Additionally, wet anomalies for such arid regions are not depicted unless the total four week precipitation exceeds 50 mm.

In some regions, insufficient data exist to determine the magnitude of anomalies. These regions are located in parts of tropical Africa, southwestern Asia, interior equatorial South Africa, and along the Arctic Coast. Either current data are too sparse or incomplete for analysis, or historical data are insufficient for determining percentiles, or both. No attempt has been made to estimate the magnitude of anomalies in such regions.

The chart shows general areas of four week precipitation anomalies. Caution must be used in relating this chart to actual precipitation.

GLOBAL TEMPERATURE ANOMALIES

1 MONTH



The anomalies on this chart are based on approximately 2500 observing stations for which at least 26 days of temperature observations were received from synoptic reports. Many stations do not operate on a twenty-four hour basis so many night time observations are not taken. As a result of these missing observations the estimated minimum temperature may have a warm bias. This in turn may have resulted in an overestimation of the extent of some warm anomalies.

In some regions, insufficient data exist to determine the magnitude of anomalies. These regions are located in parts of tropical Africa, southwestern Asia, interior equatorial South America, and along the Arctic Coast. Either current data are too sparse or incomplete for analysis, or historical data are insufficient for determining percentiles, or both. No attempt has been made to estimate the magnitude of anomalies in such regions.

Temperature anomalies are not depicted unless the magnitude of temperature departures from normal is statistically significant.

This chart shows general areas of one month temperature anomalies. Caution must be used in relation to local conditions.

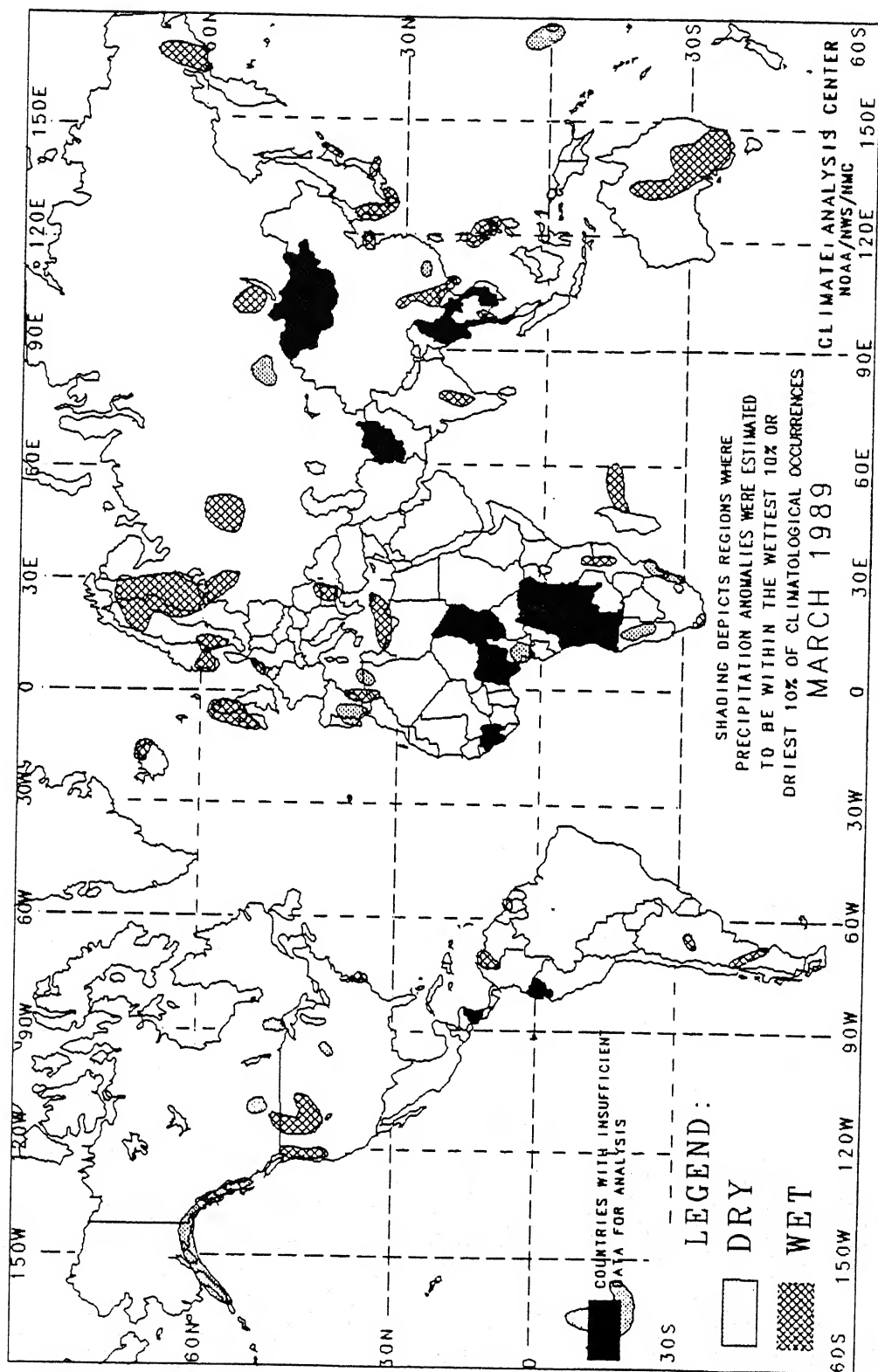
PRINCIPAL TEMPERATURE ANOMALIES

MARCH 1989

REGIONS AFFECTED	TEMPERATURE AVERAGE (C)	DEPARTURE FROM NORMAL (C)	COMMENTS
Canada	-32 to -10	-2 to -6	COLD - 5 to 10 weeks
Greenland	-36 to -14	-7 to -8	COLD - 4 to 7 weeks
Lake Superior Region	-10 to -6	-2 to -3	COLD - 4 to 9 weeks
Canadian Maritime Provinces	-10 to -1	-2 to -5	COLD - 2 to 10 weeks
Southwestern United States	+2 to +22	+2 to +5	WARM - 2 to 10 weeks
Venezuela	+18 to +28	-2 to -3	Very cool second half of March
Paraguay	+23 to +26	Around -2	Very cool middle of March
Europe and the Middle East	-6 to +17	+2 to +8	MILD - 5 to 21 weeks
Niger	Around +27	Around -2	Very cool late in March
Northern and Eastern Asia	-28 to +10	+2 to +12	MILD - 2 to 30 weeks
Southern Australia	+19 to +23	+2 to +3	Very warm first half of March

GLOBAL PRECIPITATION ANOMALIES

1 MONTH



The anomalies on this chart are based on approximately 2500 observing stations for which at least 27 days of precipitation observations (including zero amounts) were received or estimated from synoptic reports. As a result of both missing observations and the use of estimates from synoptic reports (which are conservative), a dry bias in the total precipitation amount may exist for some stations used in this analysis. This in turn may have resulted in an overestimation of the extent of some dry anomalies.

In climatologically arid regions where normal precipitation for the one month period is less than 20 mm, dry anomalies are not depicted. Additionally, wet anomalies for such arid regions are not depicted unless the total one month precipitation exceeds 50 mm.

In some regions, insufficient data exist to determine the magnitude of anomalies. These regions are located in parts of tropical Africa, southwestern Asia, interior equatorial South Africa, and along the Arctic Coast. Either current data are too sparse or incomplete for analysis, or historical data are insufficient for determining percentiles, or both. No attempt has been made to estimate the magnitude of anomalies in such regions.

The chart shows general areas of one month precipitation anomalies. Caution must be used in relating it to local conditions, especially in mountainous regions.

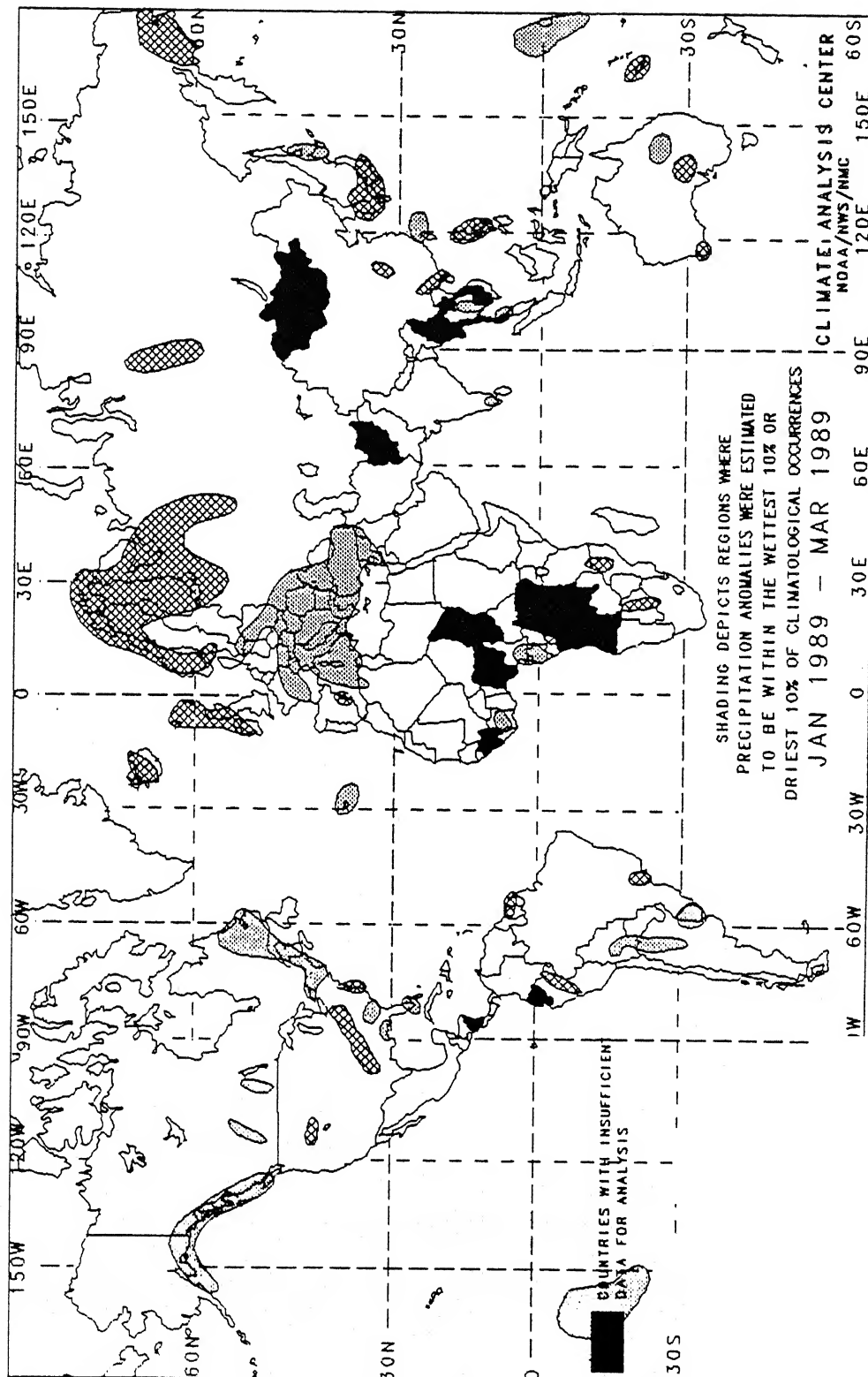
PRINCIPAL PRECIPITATION ANOMALIES

MARCH 1989

REGIONS AFFECTED	PRECIPITATION TOTAL (MM)	PERCENT OF NORMAL	COMMENTS
Southeastern Alaska	0 to 110	0 to 56	DRY - 5 to 19 weeks
Southern Alberta	0 to 8	0 to 45	DRY - 10 to 19 weeks
Western Ontario	0 to 14	0 to 50	DRY - 8 to 14 weeks
West Coast of the United States	100 to 339	136 to 215	WET - 4 to 5 weeks
Interior of Northwestern United States	28 to 88	176 to 341	WET - 4 to 10 weeks
Southwestern Iowa and Eastern Nebraska	6 to 11	12 to 27	DRY - 9 weeks
Coasts of Virginia and North Carolina	216 to 284	222 to 283	WET - 2 to 6 weeks
Cook Islands	44 to 106	19 to 47	DRY - 4 to 10 weeks
Western Venezuela	54 to 180	207 to 844	WET - 4 weeks
Suriname	175 to 344	110 to 270	Heavy precipitation second half of March
Central Argentina	149 to 203	183 to 186	Heavy precipitation early and late in March
Southern Argentina	61 to 85	286 to 318	Heavy precipitation second half of March
Northeastern Iceland	115 to 202	184 to 302	WET - 4 weeks
Ireland and Scotland	55 to 282	135 to 244	WET - 4 to 12 weeks
Low Countries	60 to 114	179 to 221	WET - 4 to 6 weeks
Southwestern Scandinavia	37 to 178	194 to 394	WET - 2 to 10 weeks
Eastern Scandinavia and adjacent Soviet Union	37 to 120	165 to 511	WET - 5 to 10 weeks
East Central European Soviet Union	50 to 52	207 to 301	Heavy precipitation second half of March
Southwestern Spain	6 to 40	8 to 49	DRY - 5 weeks
Southeastern Spain and Northwestern Algeria	54 to 90	148 to 329	Heavy precipitation second half of March
Bulgaria	50 to 121	170 to 249	Heavy precipitation early and late in March
North Central Algeria	2 to 34	7 to 35	DRY - 5 weeks
Libya and Crete	23 to 199	140 to 393	WET - 2 to 6 weeks
Cameroon and Gabon	6 to 89	8 to 50	DRY - 10 to 11 weeks
Malawi, Southwestern Tanzania, and Northwestern Mozambique	180 to 480	146 to 249	WET - 2 to 6 weeks
Namibia	4 to 22	5 to 32	DRY - 8 to 9 weeks
Southwestern South Africa	29 to 101	209 to 472	WET - 4 weeks
Eastern South Africa and Southern Mozambique	4 to 57	5 to 54	DRY - 5 to 6 weeks
Indian Ocean Islands East of Madagascar Island	363 to 862	122 to 259	WET - 2 to 4 weeks
Central India	33 to 72	236 to 661	WET - 2 to 4 weeks
Northeastern Kazakh S.S.R.	0 to 10	0 to 49	DRY - 7 weeks
South Central Siberia	14 to 90	275 to 963	WET - 4 weeks
Eastern Siberia	27 to 94	262 to 332	Heavy precipitation first half of March
Hokkaido, Japan	70 to 129	126 to 223	WET - 2 to 4 weeks
Central Japan	70 to 372	128 to 269	WET - 9 to 14 weeks
Korea and Western Japan	44 to 306	128 to 466	WET - 2 to 4 weeks
East Central China	50 to 95	401 to 446	WET - 4 weeks
Southeastern China	50 to 71	36 to 47	DRY - 8 weeks
South Central China	34 to 193	128 to 371	WET - 2 to 6 weeks
Southern Thailand	75 to 158	236 to 365	Heavy precipitation early and late in March
Philippines	97 to 415	119 to 490	WET - 6 to 14 weeks
Kiribati Islands	1 to 89	1 to 23	DRY - 6 to 25 weeks
Australia	63 to 272	141 to 1659	WET - 4 to 7 weeks

GLOBAL PRECIPITATION ANOMALIES

3 MONTHS

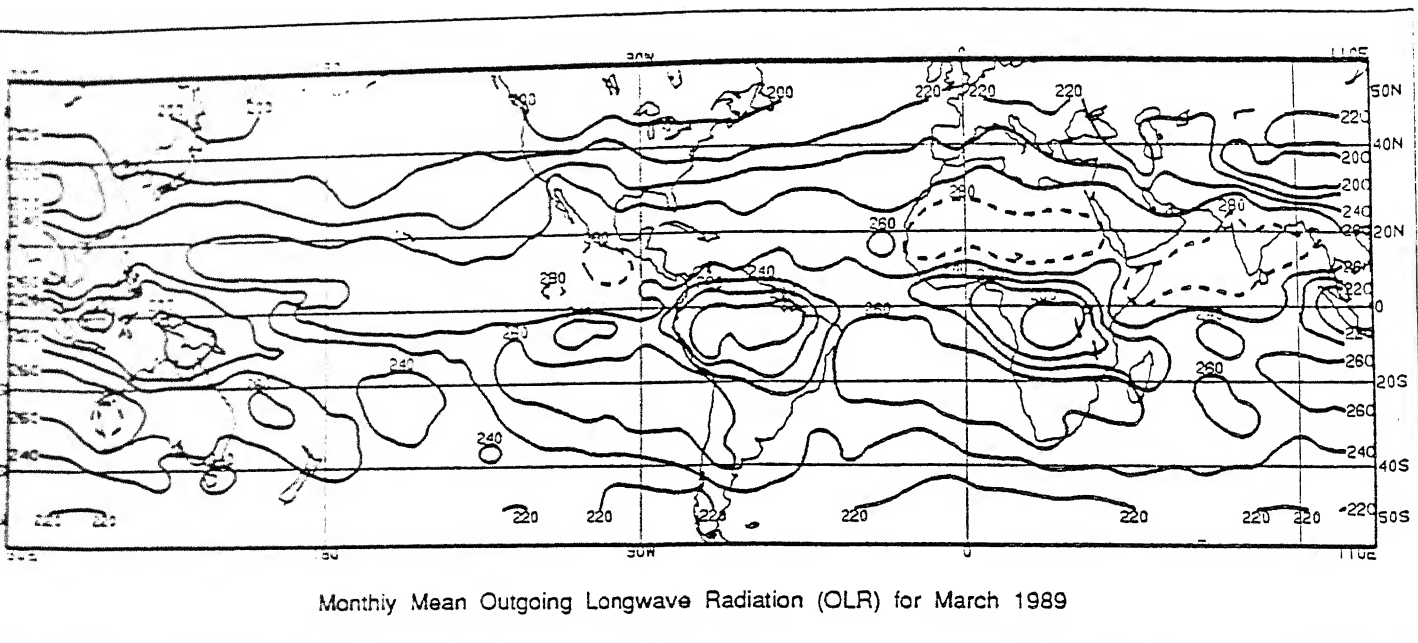


Approximately 2500 observing stations (including automatic and manual reports). As a result of sparse reports from synoptic reports, precipitation amount may vary in some regions.

precipitation for the three months depicted. Additionally, the total three

In some regions, insufficient data exist to determine the magnitude of precipitation anomalies. These regions are located in parts of tropical Africa, southwestern Asia, interior equatorial South Africa, and along the Arctic Coast. Either current data are too sparse or incomplete for analysis, or historical data are insufficient for determining percentiles, or both. No attempt has been made to estimate the magnitude of anomalies in such regions.

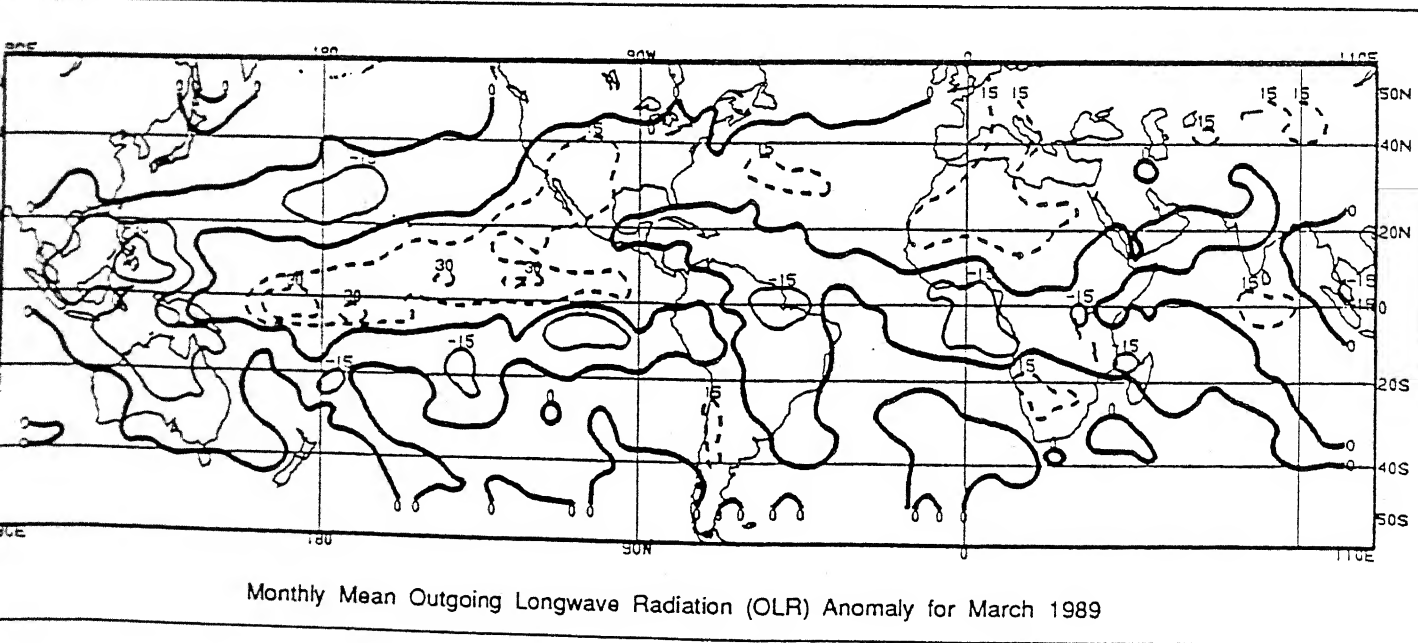
The chart shows general areas of three month precipitation anomalies. Caution must be used in relating it to local conditions, especially in mountainous regions.



EXPLANATION

The mean monthly outgoing long wave radiation (OLR) as measured by the NOAA-9 AVHRR IR window channel by NESDIS/SRL (top). Data are accumulated and averaged over 2.5° areas to a 5° mercator grid for display. Contour intervals are 20 Wm^{-2} , and contours of 280 Wm^{-2} and above are dashed. In tropical areas (for our purposes 20°N - 20°S) that receive primarily convective rainfall, a mean OLR value of less than 220 Wm^{-2} is associated with significant monthly precipitation, whereas a value greater than 260 Wm^{-2} normally indicates little or no precipitation. Care must be used in interpreting this chart at higher latitudes, where much of the precipitation is non-convective, or in some tropical coastal or island locations, where the precipitation is primarily orographically induced. The approximate relationship between mean OLR and precipitation amount does not necessarily hold in such locations.

The mean monthly outgoing long wave radiation anomalies (bottom) are computed as departures from the 1974-1983 base period mean (1978 missing). Contour intervals are 15 Wm^{-2} , while positive anomalies (greater than normal OLR, suggesting less than normal cloud cover and/or precipitation) are dashed and negative anomalies (less than normal OLR, suggesting greater than normal cloud cover and/or precipitation) are solid.



SPECIAL CLIMATE SUMMARY

CLIMATE ANALYSIS CENTER, NMC
NATIONAL WEATHER SERVICE, NOAA

SPRING PRECIPITATION BRINGS SOME RELIEF TO EUROPE AFTER A NOTABLY DRY WINTER

Previous Special Climate Summaries (WCB #89/4 dated 1/28/89, pages 13-14 and WCB #89/7 dated 2/18/89, pages 19-22) detailed the extreme dryness that had prevailed over much of southern and central Europe from December 1, 1988 to February 18, 1989 in addition to an unseasonably mild winter. Since that time, parts of southern Europe continued receiving subnormal precipitation amounts. Other areas of southern Europe and most of central Europe, however, have recorded excess precipitation from recent late winter and early spring storms. One storm system that swept across Spain, southern France, and Italy during late February dumped heavy snow (up to 40 cm) on northern Spain, while farther east, Genoa, Italy reported its worst flooding in two decades. More recently, April storms brought over an inch of snow to central Belgium-the first in more than a year, and up to 2 inches of rain in one 24 hour period across the French Riviera.

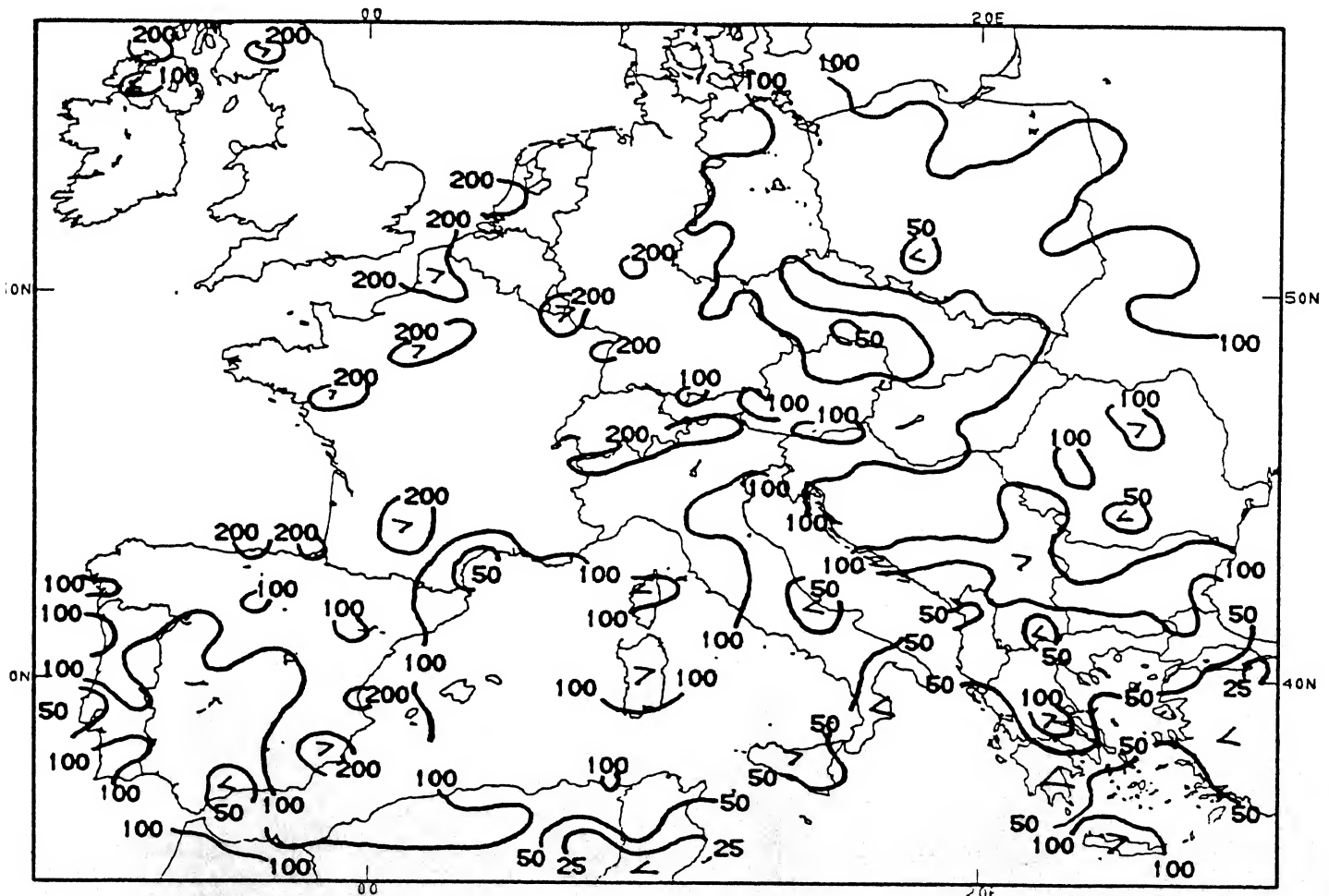
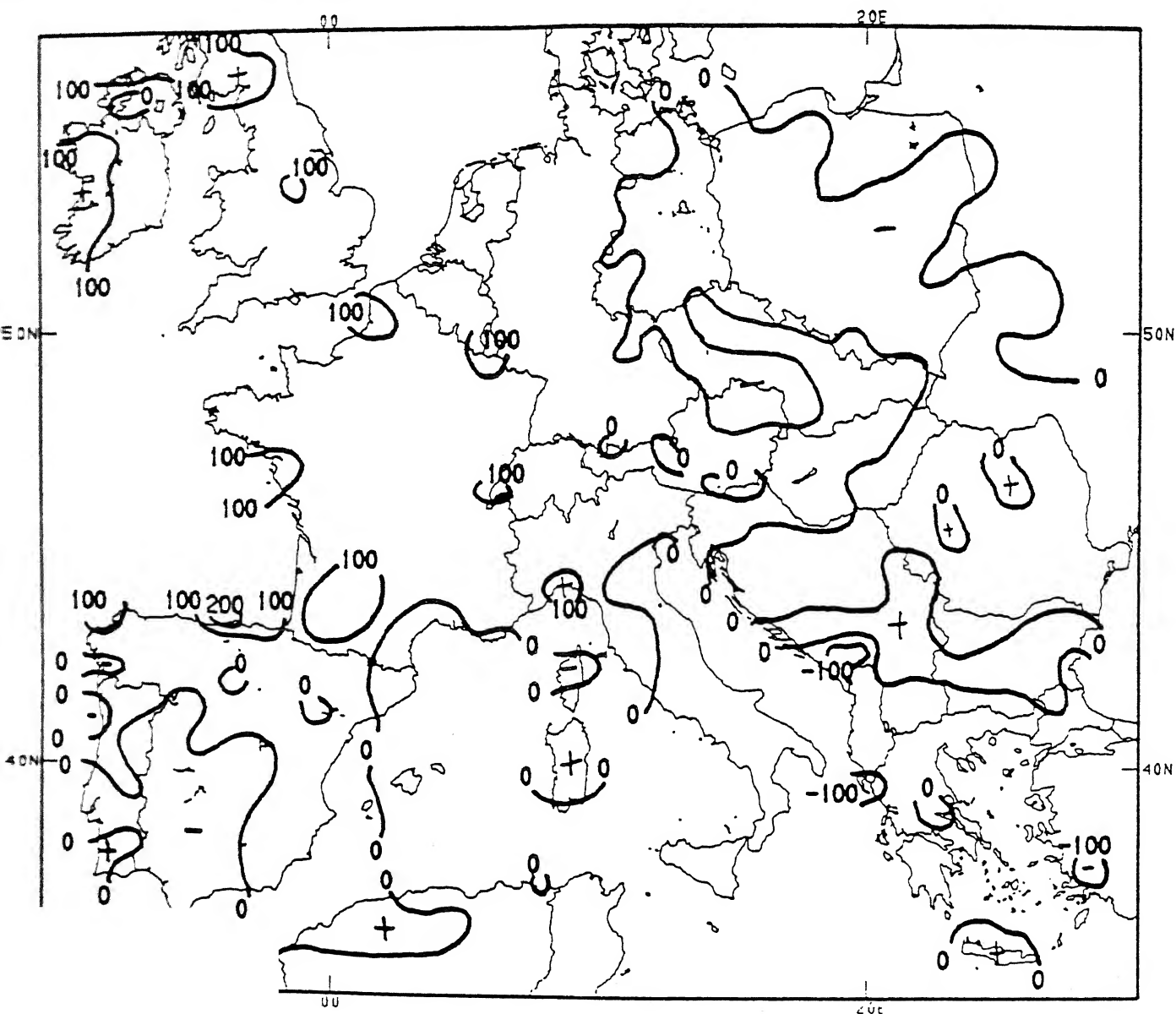


Figure 1. European percent of normal precipitation for the period February 19 - April 15, 1989. Isopleths drawn only for 200, 100, and 50.

Since February 19, 1989, most of western Europe has recorded above normal precipitation, with some regions receiving more than twice the normal amount (see Figure 1). Across eastern Europe, precipitation amounts were generally near to slightly below normal. Areas that received less than 50% of normal precipitation were located in extreme southern and east-central Italy, northern Albania, eastern Turkey and Portugal, and in southern portions of Yugoslavia, Greece, Spain and France. While isolated locations in Yugoslavia, Greece, and Turkey reported deficits greater than 100 mm, precipitation was generally between 50 and 100 mm below normal during the past 8 weeks in these abnormally dry regions (see Figure 2).



Departure from normal precipitation (mm) for the period February 19 - April 15, 1989. or 200, 100, 0, and -100 mm.

Even with the recent precipitation, the unusual dryness that prevailed across most of Europe during the winter is still evident throughout southern Europe (see Figure 3). Over the past 4 1/2 months, areas that received above normal precipitation included: Ireland and the northern United Kingdom; a wide area from northern France westward to Germany and southward to extreme western Italy; along the southeastern coast of Spain; and in the northern European U.S.S.R. In contrast, large areas of Portugal, Spain, Italy, Yugoslavia, Albania, Greece, and Turkey have measured less than a half of the normal precipitation during this period.

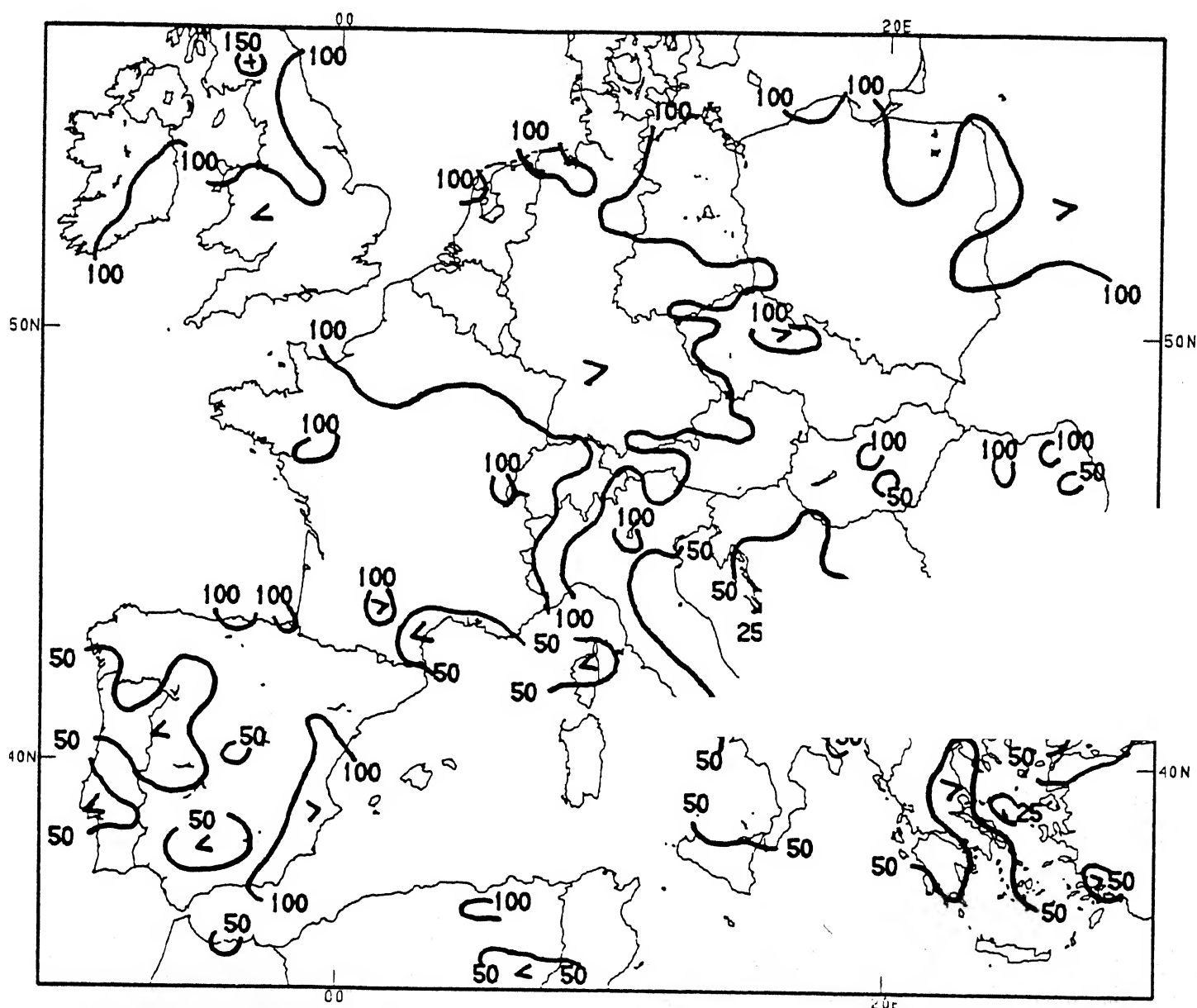


Figure 3. European percent of normal precipitation for the period December 1, 1988 - April 15, 1989. Isopleths drawn only for 100, 50, and 25.

Significant long-term precipitation deficits still existed across much of southern Europe. Since December 1, large areas of Spain, Portugal, Italy, Yugoslavia, Albania, Greece, and Turkey have accumulated deficiencies of more than 200 mm. Deficits exceeding 400 mm were found across northern Portugal, while portions of Albania and Greece have deficits surpassing 600 mm (see Figure 4).

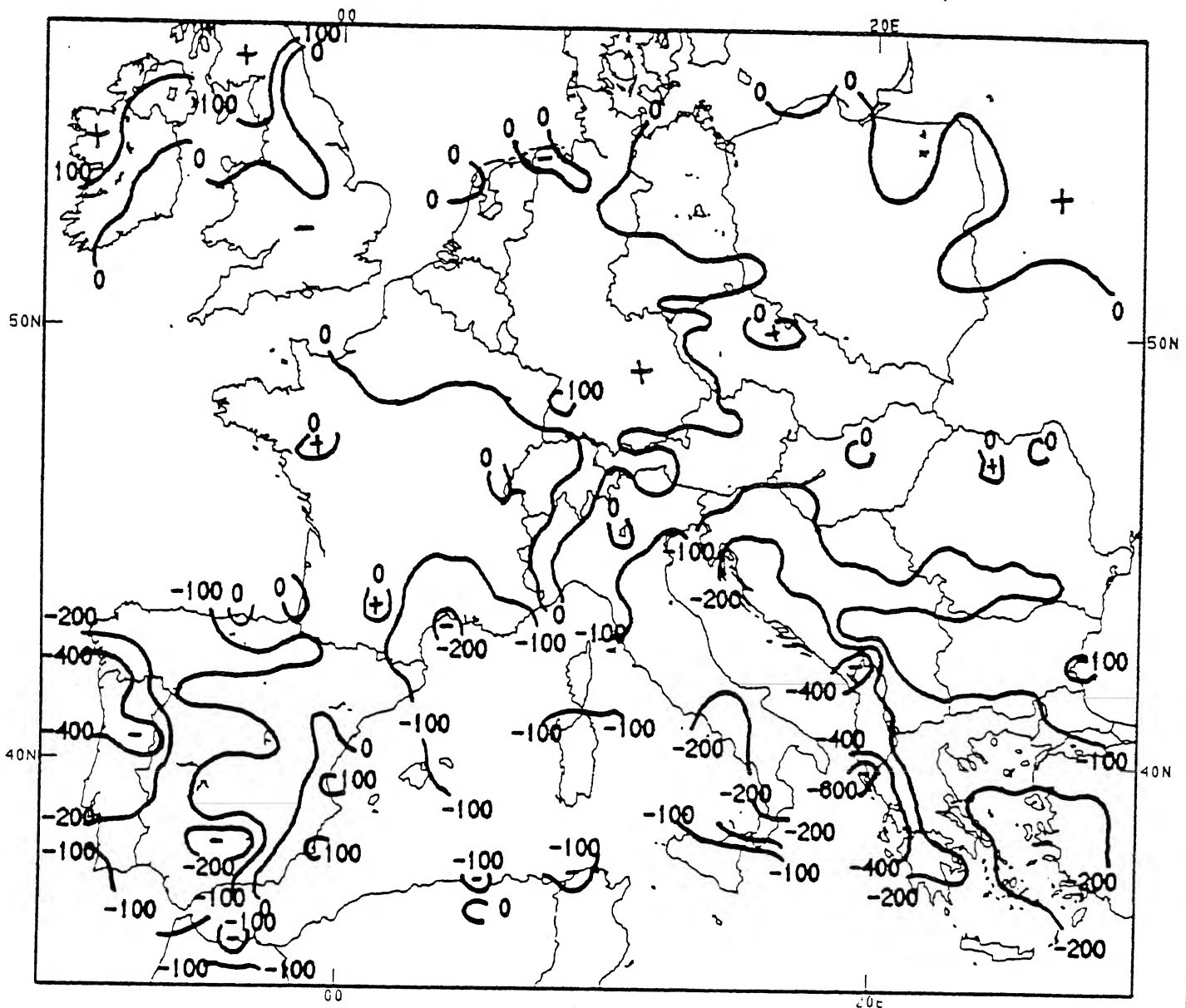


Figure 4. European departure from normal precipitation (mm) for the period December 1, 1988 - April 15, 1989. Isopleths drawn only for 100, 0 -100, -200, and -600 mm.

CLIMATE ANALYSIS CENTER, NMC
NATIONAL WEATHER SERVICE, NOAA
RECORD BREAKING WARMTH COVERS MUCH OF EUROPE
AND THE WESTERN U.S.S.R. DURING MARCH

This March was the warmest on record, based upon preliminary data, for many stations across Europe and the European Soviet Union as temperatures averaged 4-8°C above normal (see Figure 1). Unseasonably mild weather has now prevailed throughout Europe, most notably in the central and northern portions, since last December (see WCB #89/4 dated 1/28/89, page 14). While historical records at most locations began around 1950, some sites have data dating back to the mid or late 1800's. At Paris/Le Bourget, for example, the March average temperature was 10.2°C (see Figure 2) while the normal is 6.6°C. With historical records dating back to 1874 at this site, the previous record average temperature was 10.1°C observed in 1948. During March 1989, there were 5 days with observed high temperatures greater than 20°C while minimum temperatures never fell below 0°C.

Earlier this year, an upper-air ridge of high pressure built over western Europe, bringing in mild, southwesterly flow to most of the area while displacing the jet stream further north of its normal track. By early February, the ridge strengthened and slowly shifted eastward, bringing mild air eastward and northward in central and northern Europe and the western U.S.S.R. Later in the month, however, the ridge weakened, allowing storm systems to enter southern Europe. By early March, a ridge became re-established over central Europe and mild air returned to much of the continent. As a result, most of western Europe reported extreme maximum temperatures in excess of 20°C during March (see Figure 3). Temperatures greater than 25°C were recorded as far north as northern France and western West Germany.

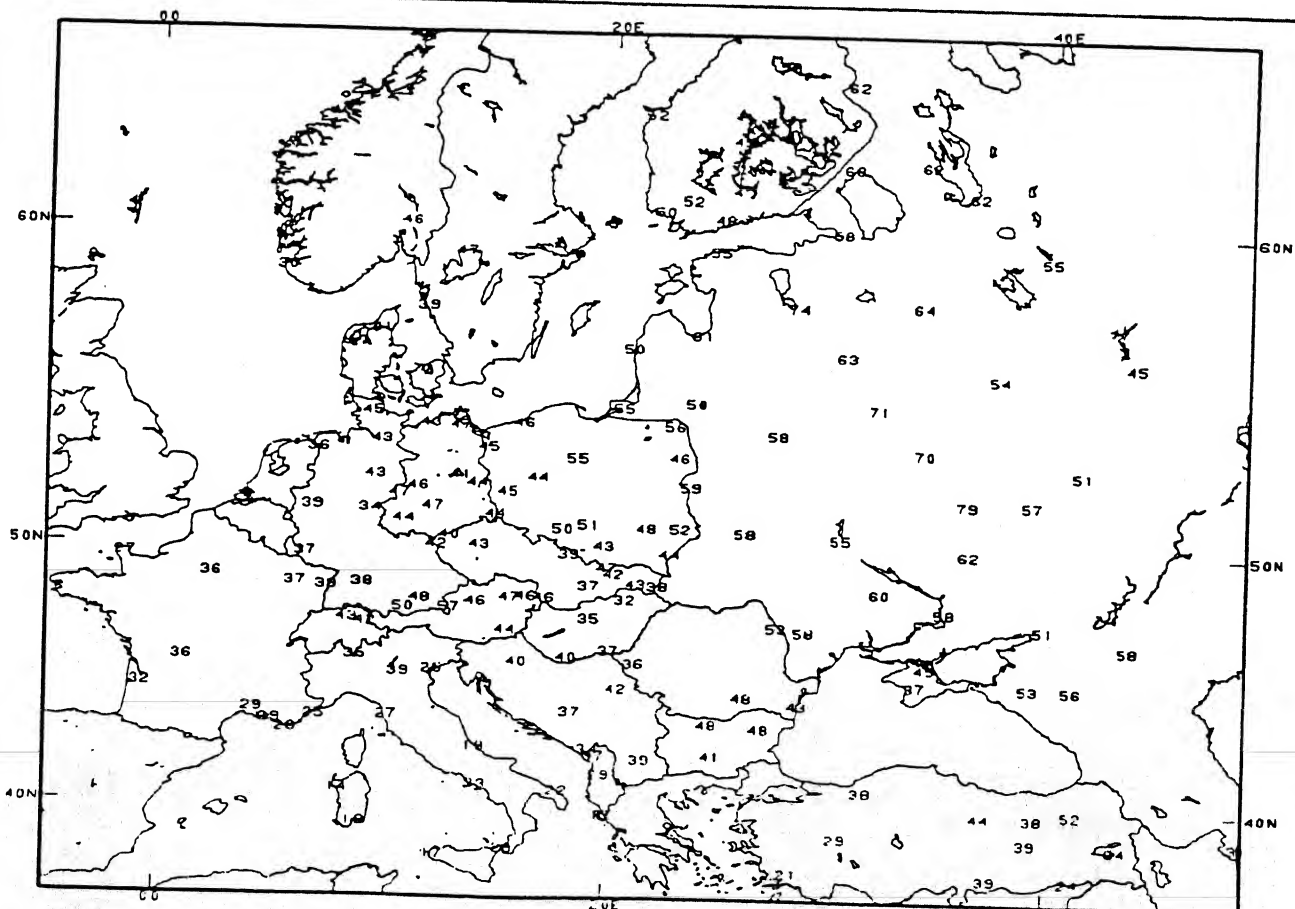


Figure 1. European record high temperature departures from normal (°C) during March 1989. Plotted values are positive temperature departures in tenths of degrees Celsius (e.g. 39 = +3.9°C).

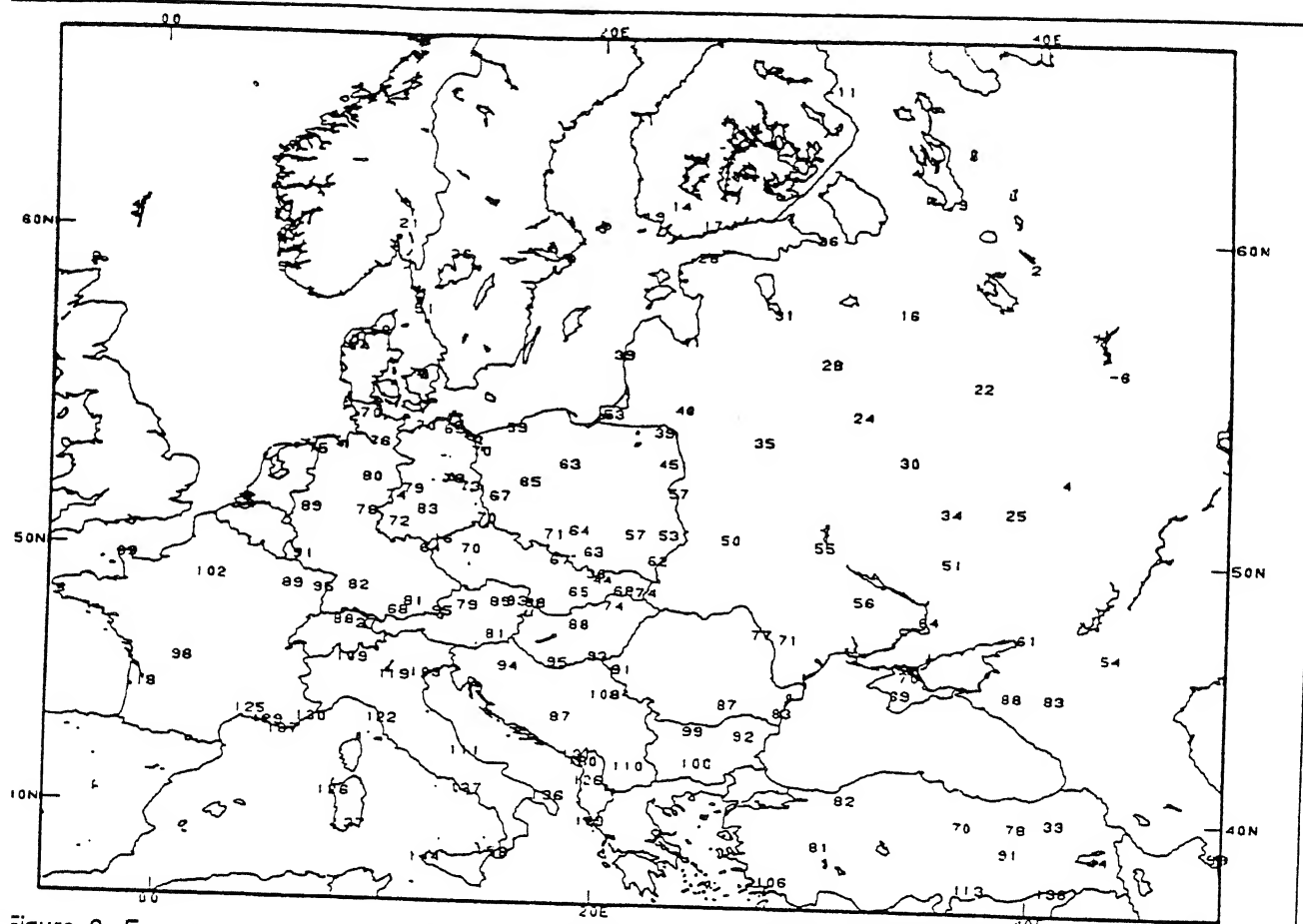


Figure 2. European record high average temperatures ($^{\circ}\text{C}$) during March 1989. Plotted values are average temperatures in tenths of degrees Celsius (e.g. 110 = 11.0°C).

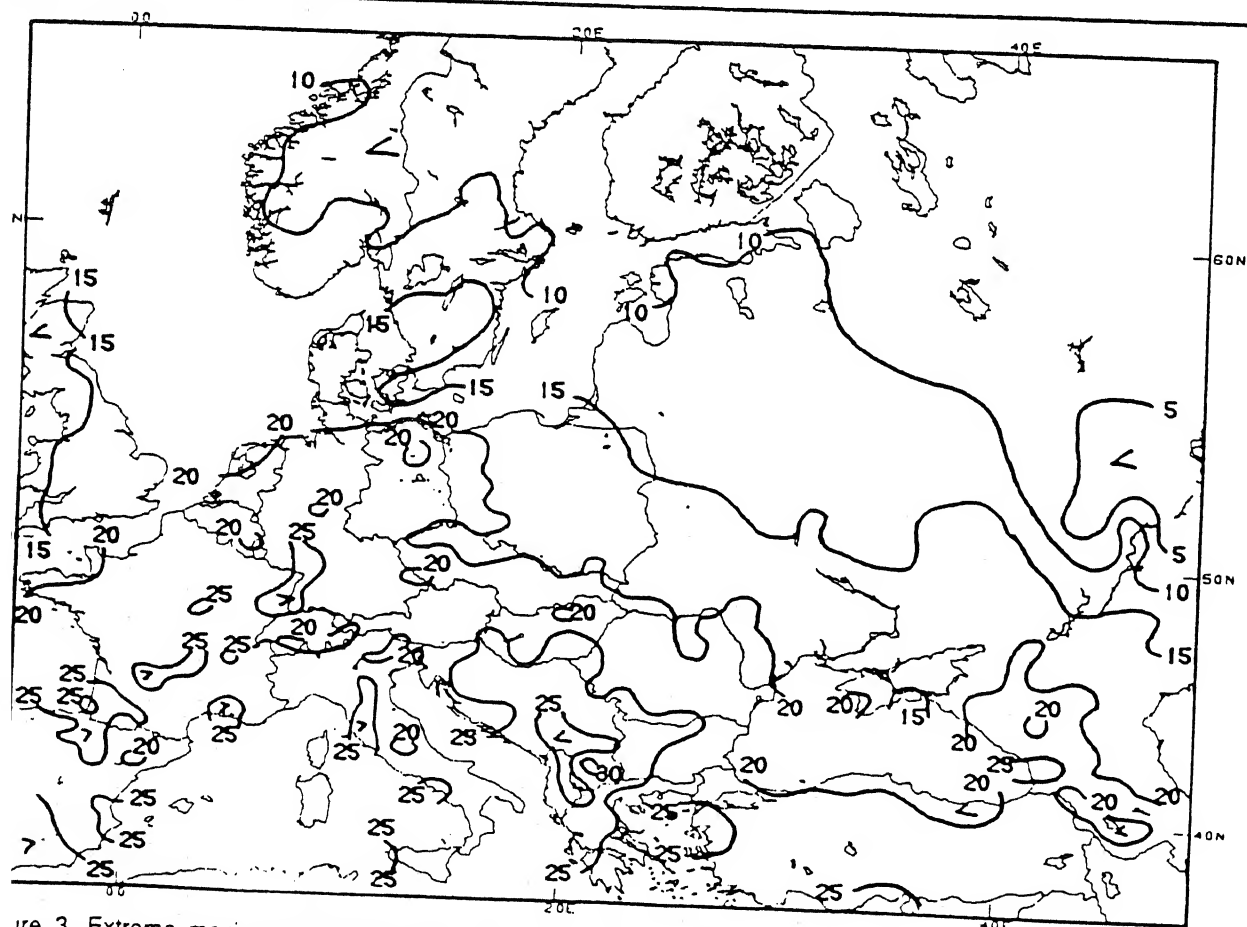


Figure 3. Extreme maximum temperatures ($^{\circ}\text{C}$) during March 1989. Isotherms are drawn only for 10° , 15° , 20° , and 30° , and isolated mountainous station values (e.g. Alps) are not analyzed.

